BROADWATER

RESOURCE REPORT NO. 8

LAND USE, RECREATION, AND AESTHETICS

FOR A

PROJECT TO CONSTRUCT AND OPERATE A

LIQUEFIED NATURAL GAS RECEIVING TERMINAL

IN

LONG ISLAND SOUND

LONG ISLAND, NEW YORK

UNITED STATES OF AMERICA

JANUARY 2006

Sensitive Security Information has been removed from this Public Volume and is contained in the Sensitive Security Information Volume.

Public

RESOURCE REPORT 8 - LAND USE, RECREATION, AND AESTHETICS

Minimum Filing Requirement	Location in Environmental Report
• • Classify and quantify land use affected by: (§ 380.12 (j) (1))	Sections 8.2 and 8.3
• • Pipeline construction and permanent rights-of-way (§ 380.12 (j) (1));	Section 8.3
• • Extra work/staging areas (§ 380.12 (j) (1));	Section 8.2
• • Access roads (§ 380.12 (j) (1));	Section 8.2
• • Pipe and contractor yards (§ 380.12 (j) (1)); and	Section 8.2
• • Aboveground facilities (§ 380.12 (j) (1)).	Section 8.2
• • Identify by milepost all locations where the pipeline right-of-way would at least partially coincide with existing right-of-way, where it would be adjacent to existing rights-of-way, and where it would be outside of existing right-of-way. (§ 380.12 (j) (1))	Section 8.3
• • Provide detailed typical construction right-of-way cross-section diagrams showing information such as widths and relative locations of existing rights- of-way, new permanent right-of-way, and temporary construction right-of-way. (§ 380.12 (j) (1))	Section 8.3; also see Resource Report No. 1 for typical drawings
• • Summarize the total acreage of land affected by construction and operation of the project. (§ 380.12 (j) (1))	Section 8.3
• • Identify by milepost all planned residential or commercial/business development and the time frame for construction. (§ 380.12 (j) (3))	Section 8.2
• • Identify by milepost special land uses (e.g., sugar maple stands, specialty crops, natural areas, national and state forests, conservation land, etc.). (§ 380.12 (j) (4))	Section 8.5
• • Identify by beginning milepost and length of crossing all land administered by Federal, state, or local agencies, or private conservation organizations. (§ 380.12 (j) (4))	Section 8.5

RESOURCE REPORT 8 - LAND USE, RECREATION, AND AESTHETICS

Minimum Filing Requirement	Location in Environmental Report
• • Identify by milepost all natural, recreational, or scenic areas, and all registered natural landmarks crossed by the project. (§ 380.12 (j) (4 & 6))	Sections 8.5 and 8.7
• • Identify all facilities that would be within designated coastal zone management areas. (§ 380.12 (j) (4))	Section 8.8
• • Identify by milepost all residences that would be within 50 feet of the construction right-of-way or extra work area. (§ 380.12 (j) (5))	Section 8.3
• • Identify all designated or proposed candidate National or State Wild and Scenic Rivers crossed by the project. (§ 380.12 (j) (6))	Sections 8.5 and 8.6
• • Describe any measures to visually screen aboveground facilities, such as compressor stations. (§ 380.12 (j) (11))	Section 8.7
• • Demonstrate that applications for rights-of-way or other proposed land use have been or soon will be filed with Federal land-managing agencies with jurisdiction over land that would be affected by the project. (§ 380.12 (j) (12))	Not applicable.

Environmental Information Request October 19, 2005	Location in Resource Report
31. Provide a breakdown of the expected total area that would be affected by anchor drop and anchor cable sweep, for each anchor, that was used to determine that 3,174 acres of seafloor would be disturbed, as presented in Section 8.3.	Section 8.3
32. Describe the easement acquisition process that would be followed with the New York State Office of General Services.	Section 8.9
33. Describe restrictions to fishing associated with the pipeline during operation. If there will not be restrictions, provide a statement to that effect.	Section 8.3.3

Environmental Information Request October 19, 2005	Location in Resource Report
34. Provide an assessment of whether or not the Project would be consistent with the Long Island Sound Coastal Management Plan and all its policies.	Section 8.8
35. With regard to recreational vessels, provide the following: a. An estimate of the number of recreational vessels likely to be temporarily displaced during each LNG carrier transit of the Race; b. The likely duration of this displacement; and c. Measures that would be incorporated into the Project to mitigate potential impacts to recreational vessels, including potential restrictions on LNG carrier transit times.	Section 8.3.7.2
36. Provide a summary description of the visual impacts, including the following: a. Potential visual impacts during daylight hours and measures that would be incorporated into the Project to avoid and minimize those impacts; and b. Potential visual impacts at night, including an assessment of the potential impacts of lights from the FSRU, LNG carriers, and other Project-related marine vessels, and a lighting plan that describes the equipment and methods that would be used to avoid or minimize impacts to human receptors and to ecological receptors in accordance with U.S. Fish and Wildlife Service guidelines.	Section 8.7 and Appendix D.

Environmental Information Request October 19, 2005	Location in Resource Report
37. Provide information on what shore-based operations would be required during construction and operation of the Project. This information should specify the planned locations and areas for all onshore support activities and facilities (such as temporary construction storage areas, warehousing of spare parts, moorage areas and refueling points for support vessels [including tugs], and communications facilities).	Section 8.2
38. Provide a series of 8½- by 11-inch maps depicting major sensitive receptors on the shorelines that extend along the assumed route of the LNG carriers. The maps should cover shorelines (including relevant islands or island groupings) from Pt. Judith on the east to the proposed FSRU location on the west, including shorelines of Rhode Island (including Block Island), New York, and Connecticut. Examples of major sensitive receptors that should be depicted include, but are not limited to: public access points, special use military zones, wildlife and marine sanctuaries and reserves, nature centers, seal haulout areas, key waterbird nesting and foraging areas, state and federal parks, federally designated scenic rivers and roads, and scientific research areas.	Section 8.2
39. State where the FSRU will be constructed.	Section 8.3
40. Section 8.3.3 identifies designated otter trawling grounds and indicates that there are no designated trawling grounds in the vicinity of the planned location of the FSRU. However, Section 8.4 states that trawling is conducted in the vicinity of the planned location of the FSRU and identifies the general trawling route. Provide a definition of "designated" trawl areas in Long Island Sound and a narrative that clarifies this issue.	Section 8.4.1

Environmental Information Request October 19, 2005	Location in Resource Report
41. Identify measures to avoid and minimize potential impacts to commercial fishermen during construction and operation of the Project.	Section 8.3.3
42. In Section 8.3.7.3, provide the following information regarding the ferry systems: a. The number of daily ferry transits for the Bridgeport-Port Jefferson crossing during the anticipated construction period; b. The number of daily transits by season for the New London-Orient Point crossing; c. The potential impacts to ferry system operations that would result from Project construction and operation, including transit of support vessels and LNG carriers; d. Specific measures that would be incorporated into the Project to minimize potential impacts to operation of the ferry systems; and e. Documentation of discussions with the operators/owners of the ferry systems regarding potential mitigation measures.	Section 8.3.7.3

Environmental Information Request January 18, 2006	Location in Resource Report
1. As requested in our EIR dated November 23, 2005, provide information on what shore-based operations would be required during construction and operation of the proposed Project. Specify the planned locations and areas for all onshore support activities and facilities.	Refer to Section 8 of the Onshore Facilities Resource Reports

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List of Acronyms and Abbreviations

bcfd	billion cubic feet per day
BMP	best management practice
BOD	biological oxygen demand
CMP	Coastal Management Plan
CTDEP	Connecticut Department of Environmental Protection
dBA	decibel
°C	degrees Celsius
°F	degrees Fahrenheit
EBP	early benthic phase
EFH	essential fish habitat
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FSRU	floating storage and regasification unit
GRT	gross registered tons
HDD	horizontal directional drilling
IGTS	Iroquois Gas Transmission System
km	kilometer
LISS	Long Island Sound Study
LISTS	Long Island Sound Trawl Surveys
LNG	liquefied natural gas
LWRP	Local Waterfront Revitalization Program
m	meter
mg/L	milligrams/liter
mm	millimeter
MAOP	maximum allowable operating pressure
MMPA	Marine Mammal Protection Act of 1972
MP	milepost

MRFSS	Marine Recreational Fishery Statistics Survey
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NYSDEC	New York State Department of Environmental Conservation
NYSDOS	New York State Department of State
NYSOGS	New York State Office of General Services
PAWSA	Ports and Waterways Safety Assessment
psi	pounds per square inch
SCFWH	significant coastal fish and wildlife habitat
SCV	submerged combustion vaporizer
SPCC	Spill Prevention, Control, and Countermeasures
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VRA	Visual Resources Assessment
YMS	yoke mooring system

8. LAND USE, RECREATION, AND AESTHETICS

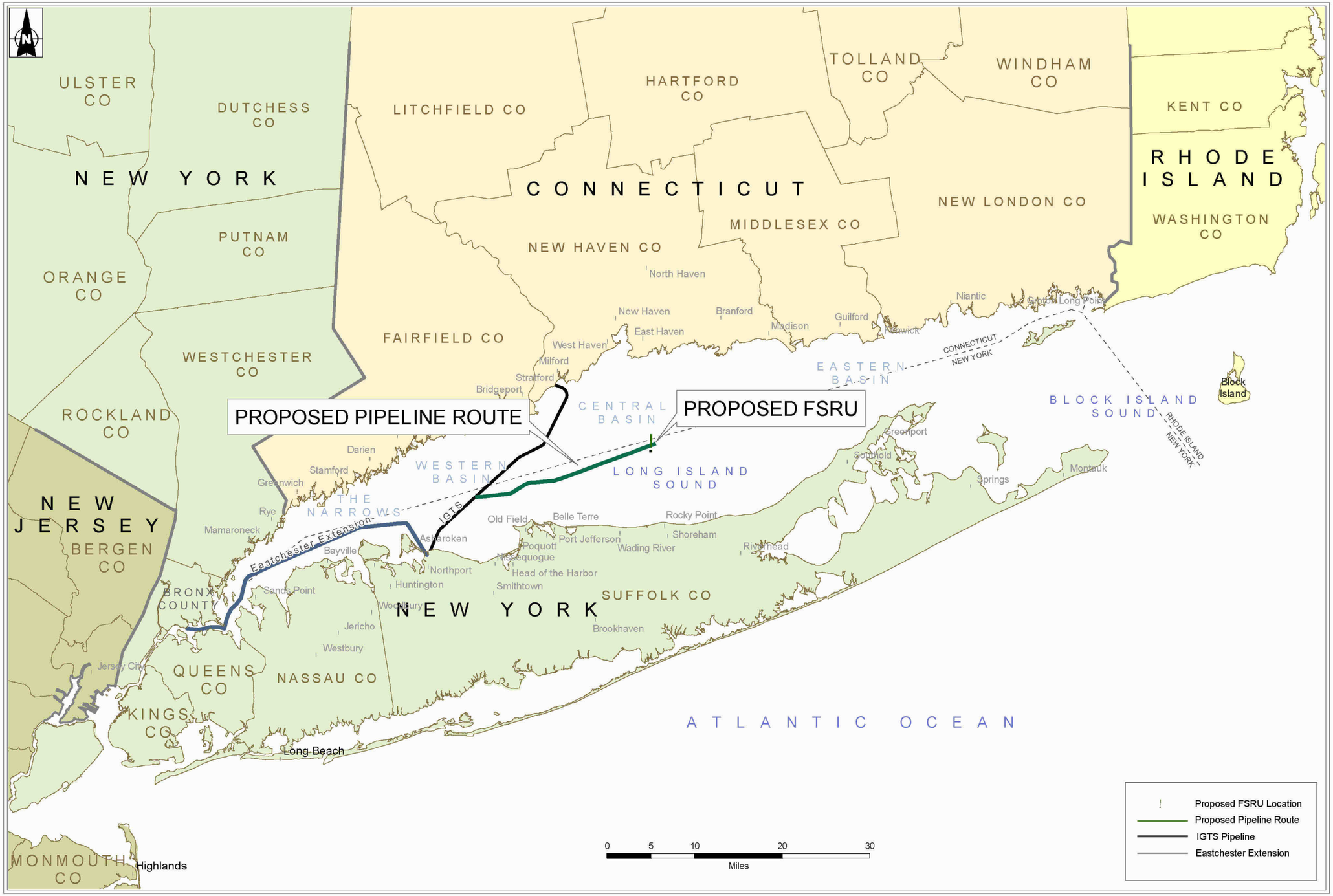
8.1 INTRODUCTION

Broadwater Energy LLC, a joint venture between TCPL USA LNG, Inc., and Shell Broadwater Holdings LLC, is filing applications with the Federal Energy Regulatory Commission (FERC) seeking all of the necessary authorizations pursuant to the Natural Gas Act to construct and operate a marine liquefied natural gas (LNG) terminal and connecting pipeline for the import, storage, regasification, and transportation of natural gas. The Broadwater LNG Project (the Project) will increase the availability of natural gas to the New York and Connecticut markets through an interconnection with the Iroquois Gas Transmission System (IGTS). The FERC application for the Project requires the submittal of 13 Resource Reports, with each report evaluating project effects on a particular aspect of the environment.

Resource Report 8 characterizes existing land uses and recreational, aesthetic, and other specially designated resources present within the Project area and identifies potential impacts on uses and resources that may occur as a result of construction and operation of the proposed Project. Measures that will be implemented to avoid and mitigate potential effects during construction and operation of the terminal also are presented.

The proposed Broadwater LNG terminal will be located in Long Island Sound (the Sound), approximately 9 miles (14.5 kilometers [km]) from the shore of Long Island in New York State waters, as shown on Figure 8-1. The LNG terminal facilitates the sea-to-land transfer of natural gas. It will be designed to receive, store, and regasify LNG at an average throughput of 1.0 billion cubic feet per day (bcfd) and will be capable of delivering a peak throughput of 1.25 bcfd. The Project will deliver the regasified LNG to the existing interstate natural gas pipeline system via a pipeline interconnection to the IGTS pipeline. Onshore facilities are discussed in the Onshore Facility Resource Reports.

The proposed LNG terminal will consist of a floating storage and regasification unit (FSRU) that is approximately 1,215 feet (370 meters [m]) in length, 200 feet (60 m) in width, and rising approximately 80 feet (25 m) above the water line to the trunk deck. The FSRU's draft is approximately 40 feet (12 m). The freeboard and mean draft of the FSRU will generally not vary throughout operating conditions. This is achieved by ballast control to maintain the FSRU's trim, stability, and draft. The FSRU will be designed with a net storage capacity of approximately 350,000 cubic meters (m^3) of LNG (equivalent to 8 billion cubic feet [bcf] of natural gas), with base vaporization capabilities of 1.0 bcfd using a closed-loop shell and tube vaporization (STV) system. The LNG will be delivered to the FSRU in LNG carriers with cargo capacities ranging from approximately 125,000 m^3 up to a potential future size of 250,000 m^3 at a frequency of two to three carriers per week.



Source: ESRI StreetMap, 2002.

Figure 8-1
Proposed Broadwater Project
Location in Long Island Sound

The FSRU will be connected to the send-out pipeline, which rises from the seabed and is supported by a stationary tower structure. In addition to supporting the pipeline, the stationary tower also serves the purpose of securing the FSRU in such a manner to allow it to orient in response to the prevailing wind, wave, and current conditions (i.e., weathervane) around the tower. The tower, which is secured to the seabed by four legs, will house the yoke mooring system (YMS), allowing the FSRU to weathervane around the tower. The total area under the tower structure, which is of open design, will be approximately 13,180 square feet (1,225 square meters [m^2]).

A 30-inch-diameter subsea natural gas pipeline will deliver the vaporized natural gas to the existing IGTS pipeline. It will be installed beneath the seafloor from the stationary tower structure to an interconnection location at the existing 24-inch-diameter subsea section of the IGTS pipeline, approximately 22 miles (35 km) west of the proposed FSRU site. To stabilize and protect the operating components, sections of the pipeline will be covered with engineered back-fill material or spoil removed during the lowering operation. Figure 8-1 presents the proposed pipeline route.

8.2 ONSHORE LAND USES

8.2.1 Regional Population

Long Island is the largest island adjoining the continental United States, extending approximately 118 miles (190 km) east-northeast from the mouth of the Hudson River. Totaling 1,377 square miles (3,580 km^2) of land area, Long Island is divided into four counties: Kings (Brooklyn), Queens, Nassau, and Suffolk. The proposed FSRU site and pipeline route are located in Suffolk County. The estimated population of Suffolk County was 1,475,488 in 2004, and the estimated population of Nassau County, which is the County immediately west of Suffolk County, was 1,339,641 in 2004. The Town of Brookhaven (estimated pop. 471,291) is Suffolk County's most populous town. The county's five eastern towns, including Riverhead, Southampton, Southold, East Hampton, and Shelter Island, had a combined estimated population of 136,850 in 2004.

With respect to the onshore populations closest to the proposed FSRU location, Table 8-1 compares the populations living within 1, 10, and 20 miles (1.6, 16, and 32 km, respectively) of the proposed Broadwater Project location and existing onshore terminals (Everett, Cove Point, Elba Island, and Lake Charles). As Table 8-1 demonstrates, the Project would have, by a significant margin, the lowest populations living within 1 mile (1.6 km) and 10 miles (16 km) of the LNG terminal.

Figures 8-2 and 8-3 present population densities for onshore areas of Long Island, Connecticut, and Rhode Island. Figure 8-2 also presents the population estimate at 9 miles, the distance from the proposed FSRU location to the shore of Long Island.

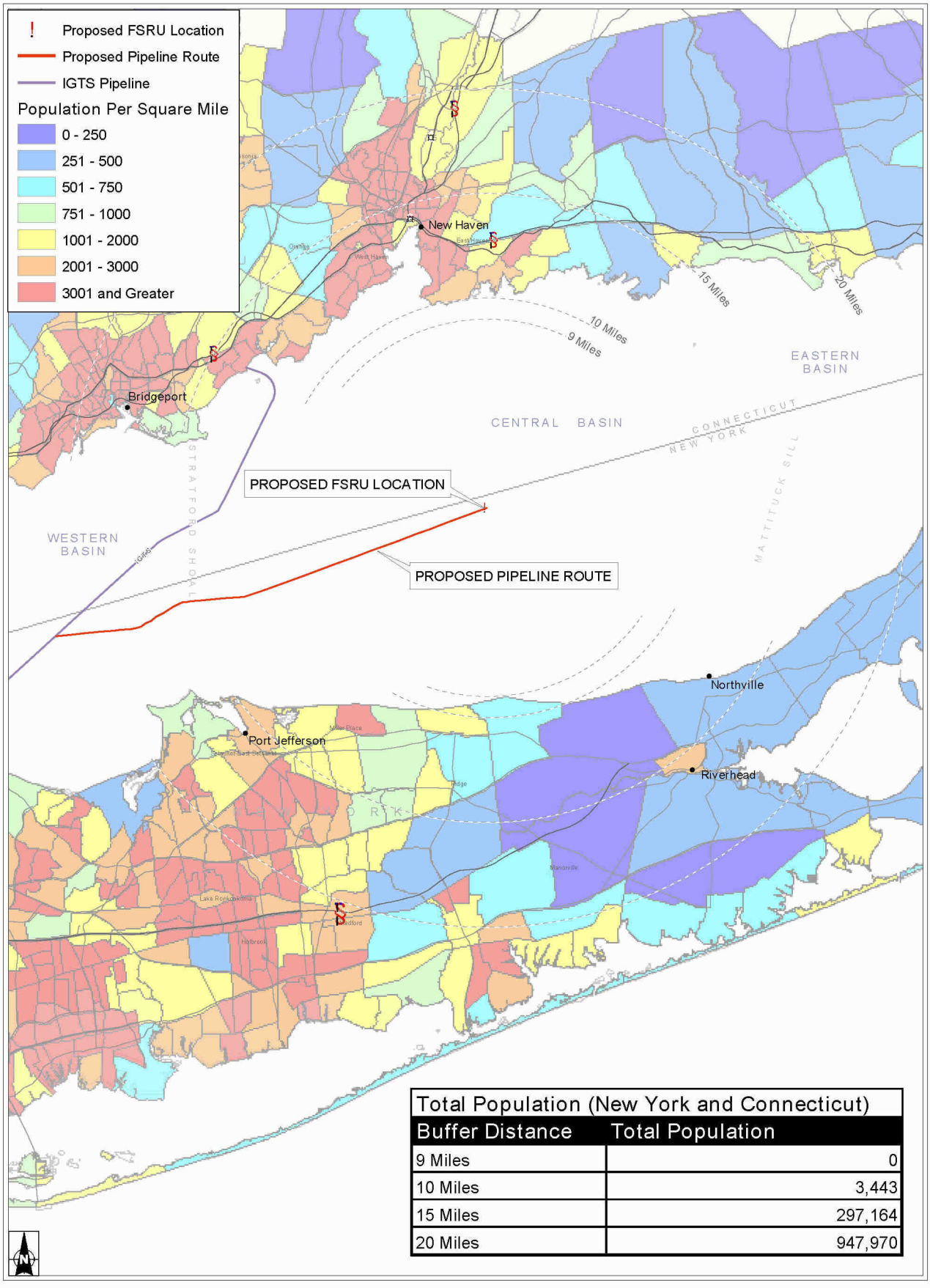


Figure 8-2 Population Densities within 9, 10, 15 and 20 Miles of the Proposed FSRU Location

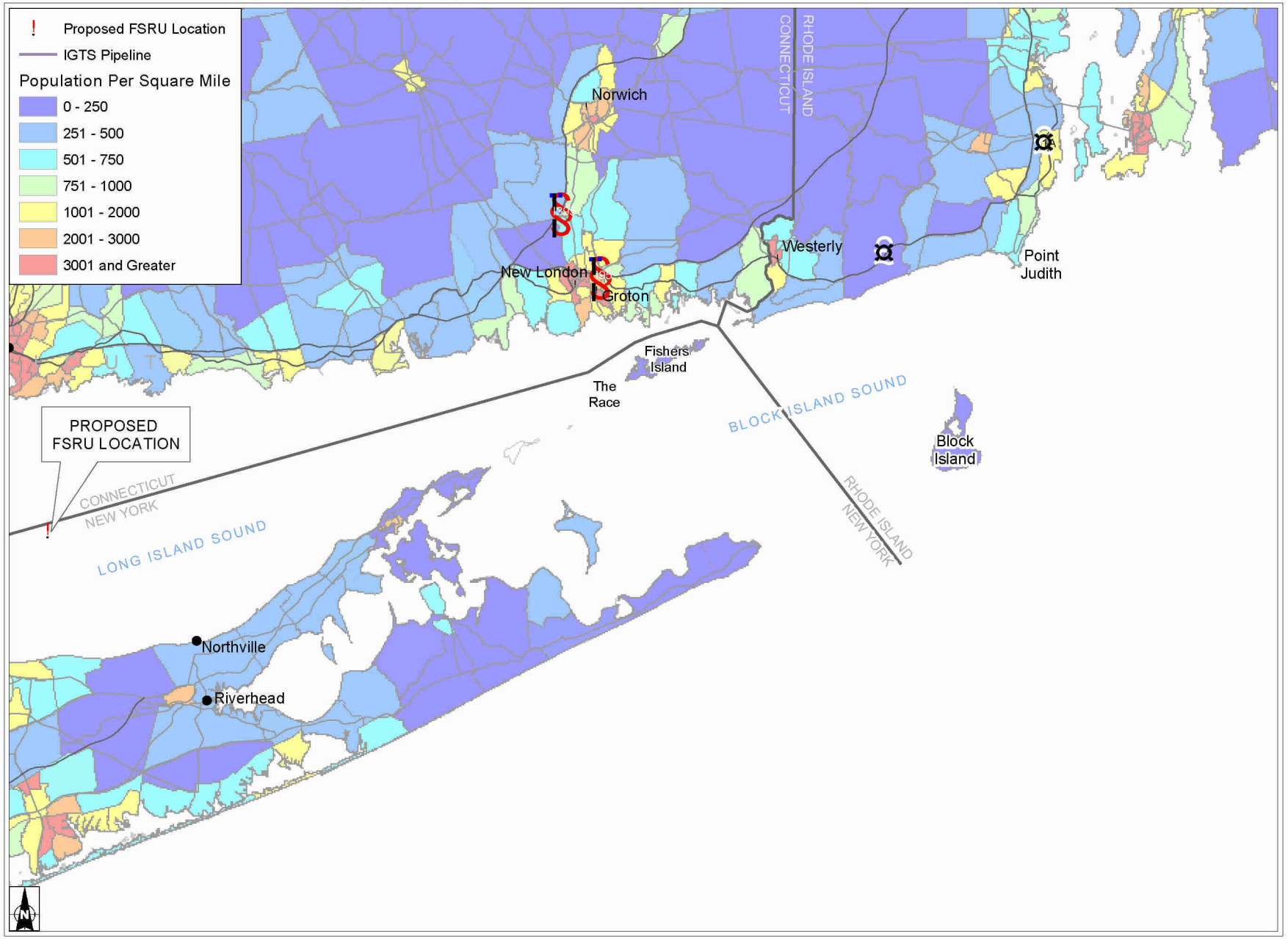


Figure 8-3 Population Densities in the Vicinity of the Race

Table 8-1 Populations in Proximity to the Broadwater Project and Existing Onshore LNG Terminals in the United States

LNG Facility	Estimated Population[1] within 1 mile	Estimated Population within 10 miles	Estimated Population within 20 miles
Broadwater	0	3,443	947,970
Everett	33,585	1,745,898	2,758,510
Cove Point	751	49,014	135,779
Elba Island	528	154,193	292,148
Lake Charles	2,995	136,825	202,081

Source: U.S. Bureau of the Census 2001.

[1] Estimates were obtained by analyzing populations within the census tracts that fell within each buffer zone. For census tracts that were partially traversed, an estimate of the percentage of the tract crossed was determined and the appropriate percentage applied.

Based on the offshore location, the FSRU and interconnecting pipeline will have no affect on onshore populations or onshore land uses, nor is it anticipated to affect onshore coastal or waterfront patterns of development.

8.2.2 LNG Carrier Route Analysis

In addition to analyzing the onshore coastal regions in the immediate vicinity of the Project, Broadwater also conducted an analysis of major sensitive receptors on the shorelines that would be adjacent to LNG carrier routes entering into Long Island Sound from the Atlantic Ocean. The analysis covers shorelines and relevant offshore features from Point Judith, Rhode Island, and Montauk, New York, to the entrance into Long Island Sound at the Race and onward to the proposed FSRU location. This analysis includes shoreline features along Rhode Island, including Block Island, as well as the far eastern shorelines of New York and Connecticut.

In general, the analysis indicates that no major coastal features would be significantly impacted by the proposed LNG carrier or associated USCG-identified safety and security zone that likely will be enforced around the carrier as it transits to the FSRU location. (*See* Resource Report 3 [Fish, Wildlife, and Vegetation] for potential impacts on marine ecological resources.)

Broadwater is currently engaged in consultation with the USCG concerning the preferred routing that LNG carriers would take to enter and transit Long Island Sound, as well as the requirements for any safety and security zone that would surround the LNG carrier as it made its transit through the Sound.

An LNG carrier will transit to the proposed FSRU on average once every two to three days. Based on preliminary routing, there are two routes that LNG carriers may take when sailing into Long Island Sound via the Race. These two entry routes include:

- The Northern Route, which runs between Block Island and Point Judith, Rhode Island; and

- The Southern Route, which enters Block Island Sound via the Montauk Channel.

For both routes, the LNG carriers would be nearest the shoreline as they enter and exit Long Island Sound via the Race. A more detailed discussion of the two LNG carrier routes is provided in Appendix A.

Scheduling of LNG carrier arrivals will take into account use of the area by other marine traffic and will require close cooperation between Broadwater, the USCG, pilots, and other operators (*see* Resource Report 11, Safety and Reliability). Scheduling of LNG carrier arrivals is a very important issue for Broadwater with respect to limiting impacts on other users of the Sound because a traveling, USGC-imposed safety and security zone will likely be enforced around the LNG carrier, which may limit use in the area adjacent to the carrier. It is important to note that, based on an anticipated carrier speed of 12 knots, the approximate duration of a traveling safety and security zone at any single point would be only approximately 15 minutes. Based on review of existing NOAA charts, the transiting LNG carrier would not result in any bottlenecks that would prevent other commercial or recreational traffic from transiting the Race. No more than one carrier associated with the Project would be in the Sound at any given time. If a second LNG carrier were to arrive with cargo while an LNG carrier is in the Sound, the second carrier would remain outside of the Sound until the first carrier has exited the Sound.

In general, onshore/coastal land uses along the assumed LNG carrier routes do not differ substantially along the New York, Connecticut, or Rhode Island shorelines (*see* Figure 8-4). The majority of the coastal land uses along these shorelines are a mix of forested and agricultural land, with some residential uses interspersed within this overall pattern. In addition, the overall population densities along these routes are fairly consistent for all three states, with a majority of the population densities ranging from 0 to 500 people per square mile (*see* Figure 8-3). The exception to this is the coastal areas around New London, Connecticut, and Westerly, Rhode Island, where densities increase substantially. As shown on Figure 8-3, population densities in this area can exceed 3,000 people per square mile. Near New London and Westerly, however, it is expected that the LNG carrier would be a minimum of 4.3 to 6.1 nautical miles (nm) (5 to 7 statute miles) from the Rhode Island/Connecticut shoreline.

An LNG carrier's closest approach to inhabited land would be 1 nm (1.2 statute miles) as it transits south of 3,200-acre Fishers Island. This 7-mile-long, 0.75-mile-wide island is located about 10.4 nm (12 statute miles) northeast of Orient Point, New York, and 3.5 nm (4 statue miles) south of Connecticut. Fishers Island has a permanent population of 269 people, although the population increases seasonally with summer residents and tourists. The island is accessible only by boat or plane and is characterized as a high-end

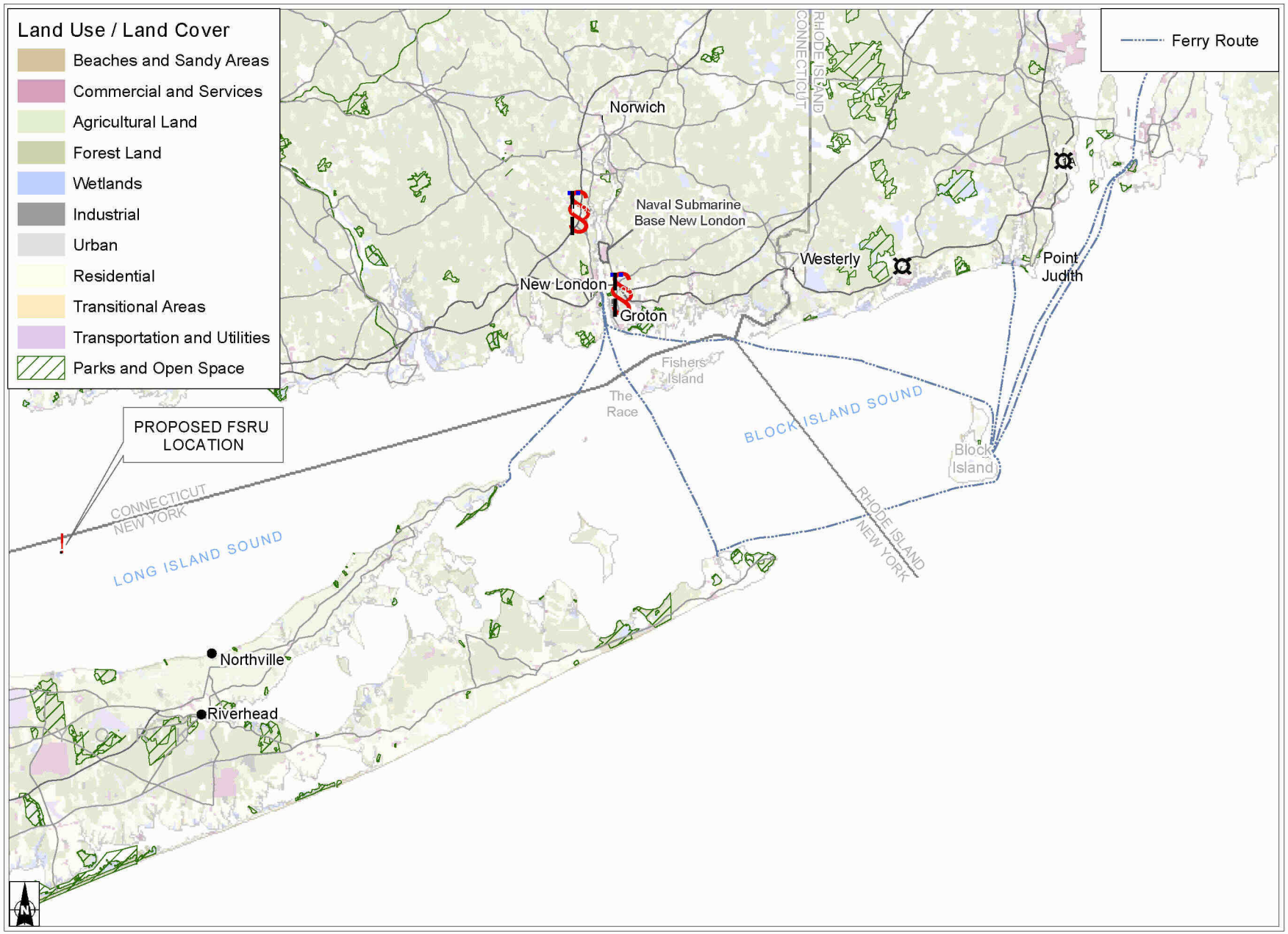


Figure 8-4 Land Use in the Vicinity of the Race

residential resort community with a small village, residential homes, and recreational amenities such as golf courses and resorts.

Montauk Point State Park is the largest coastal park occurring along the LNG carrier routes. The park, situated on the eastern tip of Long Island near the historic Montauk Lighthouse, is primarily forested. At its closest approach, the LNG carrier would be approximately 6.1 nm (7 statute miles) from Montauk Point. However, because of its topography the park offers wide-open, unobstructed views of the water at various points, and the LNG carrier may be visible from these locations. Because of the number of larger commercial vessels that currently utilize the Sound, users of this park would be accustomed to seeing offshore vessel traffic and would not be adversely impacted.

In addition, several smaller parks and open-space areas are located on the Connecticut shorelines; however, at its closest approach the LNG carrier would be over 3.5 nm (4 statute miles) from these coastal parks. As with Montauk State Park, users of these parks would already be accustomed to large commercial vessel traffic on the Sound and would likely not be impacted.

In addition to traversing along coastal areas, the LNG carrier would also cross several existing ferry routes, specifically the Montauk-to-Block Island high speed ferry route, the Block Island-to-Connecticut and Rhode Island ferry routes, and the New London-to-Orient Point ferry routes. Potentially impacted ferry services and routes are discussed in more detail below.

As mentioned previously, a discussion of impacts on marine ecological resources is provided in Resource Report 3, Fish, Wildlife, and Vegetation.

8.2.3 Onshore/Aboveground Facilities

A separate document that addresses land use, recreation, and aesthetics issues for Broadwater's onshore facilities was prepared. This assessment includes an analysis of onshore areas proposed for construction yards and shore-based facilities on Long Island required to support the Project.

8.3 OFFSHORE LAND USES

The proposed project will be located in an open-water environment within Long Island Sound. The land use within which the project will be constructed and operated is designated entirely as open water. The project area falls under certain jurisdictions of the State of New York as the Project is entirely located within the New York portion of Long Island Sound. Neither the FSRU nor its connecting pipeline will be co-located with any other existing facilities and will be constructed as a new right-of-way.

Where the pipeline is installed using the proposed subsea plow construction techniques, the primary work area for laying and lowering the pipe on the seafloor will be approximately 75 feet wide, and roughly centered on the pipe. This width accounts for both the pipeline trench and spoil piles on either side of the trench excavated by the subsea plow. It is estimated that 197 acres of seafloor will be disturbed during the subsea

plow installation of the pipeline. Additional seafloor disturbance associated with pipeline installation will result from the anchor cable sweep required for barge-mounted construction activities. Approximately 2,020 acres of seafloor will be disturbed by anchor cable sweep (*see* Table 8-2).

Table 8-2 Broadwater Pipeline Installation, Summary of Sediment-Related Impacts

Impact Type	Sediment Volume (cu yards)	Impact (acres)	Comment
Pipeline Lowering via Plow; 19.7 miles with 3 feet of cover (MP 2.0 – MP 21.7)	304,500	179.1	Impacts include both the trench and associated spoil mounds.
Pipeline Lowering via Plow; 2 miles with 5 feet of cover (MP 0.0 – MP 2.0)	39,500	18.2	In proximity to the FSRU, the pipeline will be lowered to a greater depth to accommodate design considerations.
AT&T Cable Crossing (MP 6.4)	3,030	0.4	Impacts include excavations for crossing bridge and pipeline trench transition.
Cross Sound Cable Crossing (MP 3.0)	3,030	0.4	Impacts include excavations for crossing bridge and pipeline trench transition.
FSRU Tie-in (MP 0.0)	1,650	0.2	Includes expansion loop.
Check and Isolation Valve Spool (MP 0.4)	270	<0.1	Located approximately 2,000 feet from the FSRU.
IGTS Tie-in (MP 21.7)	2,340	0.3	Includes expansion offset.
Anchor Footprint	N/A	16	8-point mooring, 3 anchor sets per mile, and 3 passes (one lay, and two plow)
Anchor Cable Sweep	N/A	2,020	8-point mooring, 3 anchor sets per mile, and 3 passes (one lay, and two plow). Includes the use of mid-line buoys on the quarter anchors.
Total	354,320	2,234.7	

At the IGTS and FSRU tie-ins and the AT&T and Cross Sound cable crossings, a check and isolation valve spool, hand excavation, and use of a submersible slurry pump will be required for excavation activities. Each of these five locations will disturb less than 0.5 acre of bottom, subject to final engineering design.

A detailed discussion of the offshore construction techniques are provided in Resource Report 1, General Project Description. The effects of construction on Long Island Sound are discussed in Resource Report 2, Water Use and Quality.

Although the FSRU itself will not result in any bottom disturbance, the facility will be moored to the seabed of Long Island Sound by the YMS, which includes a stationary tower structure with a footprint of approximately 13,180 square feet (1,225 m^2).

The FSRU, YMS, and supporting tower structure will be constructed at existing shipyards using existing facilities outside of the Project area, most likely overseas, and towed to the Project site in Long Island Sound.

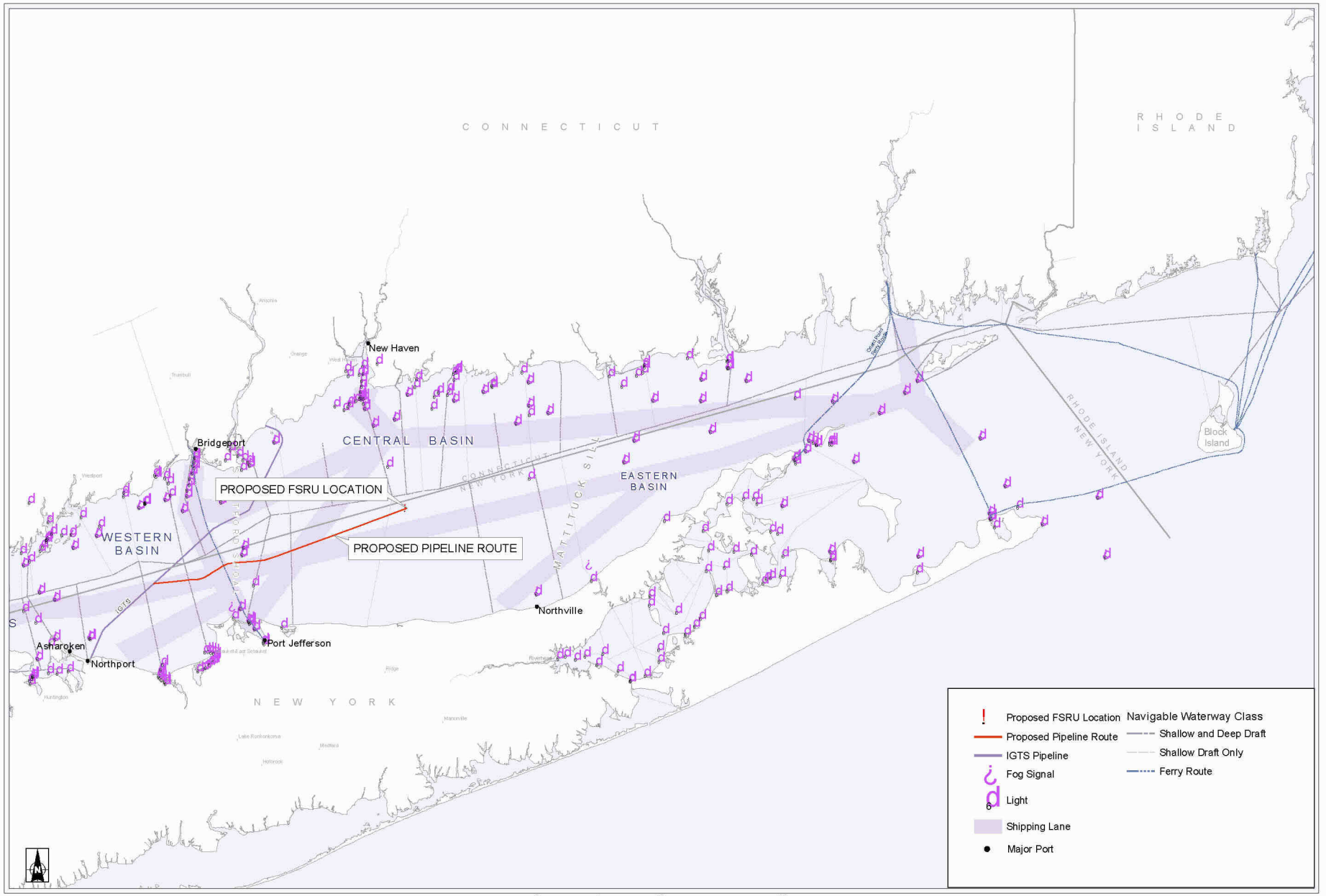
8.3.1 Shipping Routes and Designated Navigable Waters

Navigation-dependent activities are very important to the economies of New York and Connecticut. Broadwater sited the FSRU and interconnecting pipeline to minimize impacts on shipping and navigable waterways. Official vessel traffic routing does not exist within Long Island Sound. In the absence of a routing scheme in Long Island Sound, federal navigational aides and the use of standard marine practice have led to the development of established traffic patterns and generalized shipping routes in the Sound. The main shipping route runs generally down the center of the Sound on a straight course from deepwater areas in the eastern Sound to the deepwater pass through Stratford Shoal. A second primary shipping route exists on a northeast to southwest alignment toward the Northport Harbor area in New York. From both of the two primary east-west shipping routes, traffic branches to enter the existing deepwater ports throughout the Sound (*see* Figure 8-5). Due to the greater port development in Connecticut, significantly more routes branch toward the Connecticut shoreline. A specific motivating factor in locating the proposed FSRU outside of these traffic patterns was to minimize impacts on commercial shipping.

Due to the greater depths through the central portion of Long Island Sound (greater than 66 feet [20 m]), maintained navigation channels are restricted to nearshore areas and within the rivers and harbors along the Sound. The locations of ports within the Sound and the presence of Stratford Shoal, which is centrally located in the Sound, largely dictate the specific paths that shipping follows in the Sound (*see* Figure 8-5). Broadwater has been located between the primary routes used to access ports in New York and Connecticut.

Navigational warnings and precautions will be implemented so as to not impede vessel traffic during the period required for pipeline construction and installation of the FSRU mooring structure. In addition, Broadwater will coordinate with the USCG, and a Notice to Mariners will be issued with installation details. Construction vessels associated with the Project will maintain an open line of communication with all vessels during construction and installation activities.

Following installation of the FSRU, navigation charts will be updated to incorporate its location. Navigational aids (e.g., lights and foghorns) will be permanently installed on the facility to provide adequate warning to surrounding vessels, and these also will be indicated on updated nautical charts.



Source: U. S. Geological Survey Open-File Report OFR 00-304, 2000,
U. S. NOAA Electronic Nautical Charts.

Figure 8-5 Major Ports and Shipping Routes in Long Island Sound

8.3.2 Subsea Utilities

Several cables, pipelines, and other utilities traverse the bottom of Long Island Sound. These utilities are largely buried beneath the seafloor except in specific locations where rock or other obstructions prevent complete burial. The Project's pipeline will cross subsea rights-of-way and other designated uses between the FSRU and Iroquois tie-in location. These crossings are described below and indicated on Figure 8-6. Impacts on these existing subsea utilities will be restricted to temporary impacts during the construction phase of the Project. Resource Report 1, General Project Description, provides details regarding specific techniques that will be used to traverse subsea utilities.

- **Cross Sound Cable.** This submarine power cable traverses the Sound from New Haven, Connecticut, to Shoreham, New York. The proposed pipeline route will require a single crossing of this cable.

- **AT&T Cable Corridor.** This submarine fiber-optic telecommunications cable corridor traverses the Sound from Shoreham, New York, to East Haven, Connecticut. The proposed pipeline route crosses the corridor and associated cables.

- **IGTS Pipeline.** This pipeline runs from Northport, New York, to Milford, Connecticut. This pipeline is the terminus of the proposed subsea pipeline via a subsea connection.

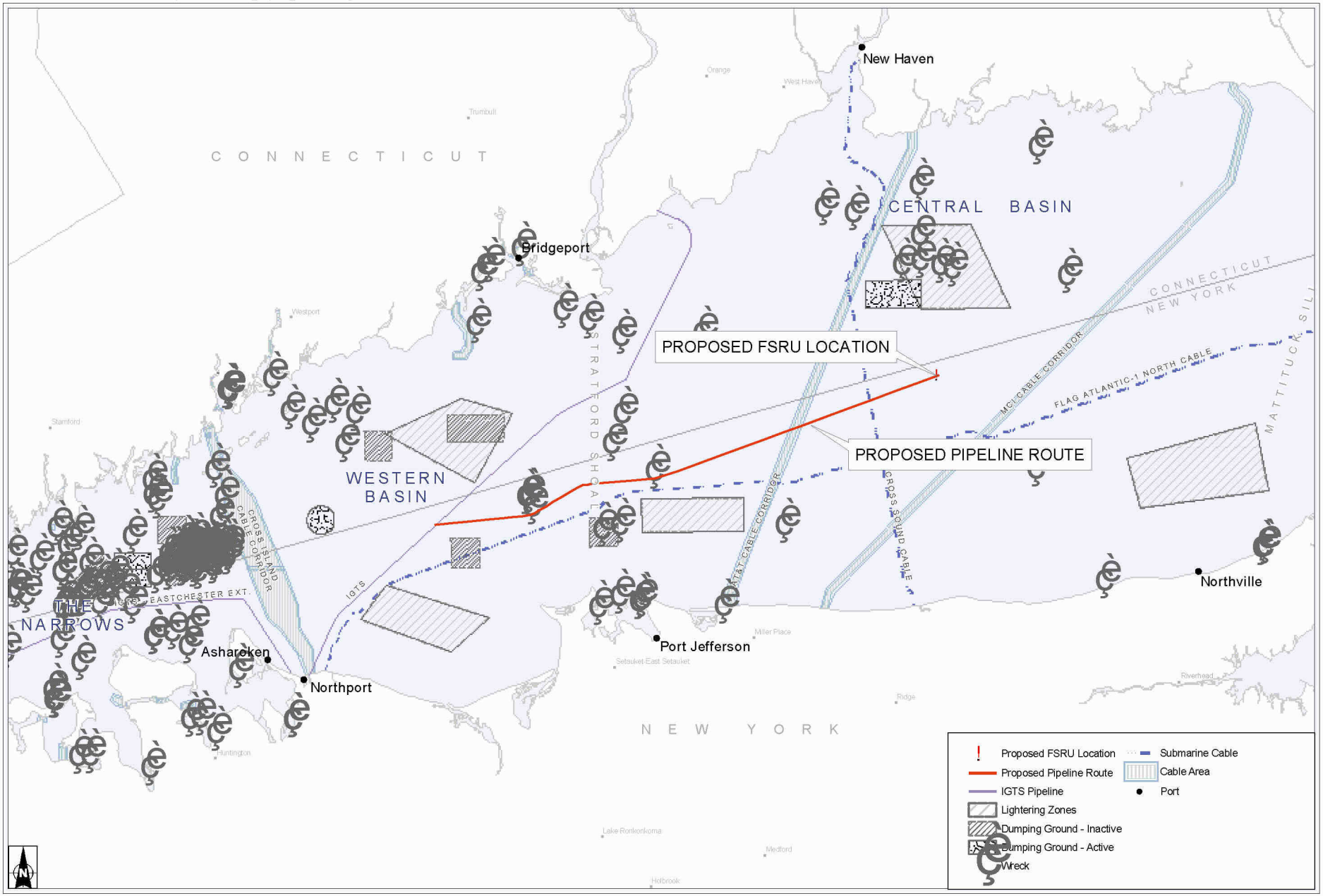
Additional utilities that are located, or proposed to be located, in the general Project vicinity but are not impacted by the Project include the following:

- **MCI Cable Corridor.** This fiber-optic telecommunications cable corridor runs from Rocky Point, New York, to Madison, Connecticut. It is located east of the proposed FSRU location.

- **Cross Island Cables.** These seven power cables are contained within a corridor that crosses Long Island Sound from Northport, New York, to Norwalk, Connecticut. The corridor is located west of the proposed pipeline's western terminus at the IGTS pipeline.

- **Flag Atlantic-1 North Cable.** This trans-Atlantic fiber-optic telecommunications cable extends from Northport, New York, to England. The portion of the cable in Long Island Sound runs south of the New York/Connecticut border and provides a direct communication link between New York City, London, and Paris. This cable is located south of the proposed pipeline route and will not be impacted by the Project.

- IGTS Eastchester Extension. This pipeline runs east-west in the Sound from Northport to Eastchester, New York, west of the Project area.



Source: U. S. Geological Survey Open-File Report OFR 00-304, 2000,
U. S. NOAA Electronic Nautical Charts.

0 2.5 5 10
Miles

Figure 8-6 Marine Uses
in Long Island Sound

- **Islander East Pipeline.** This proposed pipeline is routed to the east of the Project area.

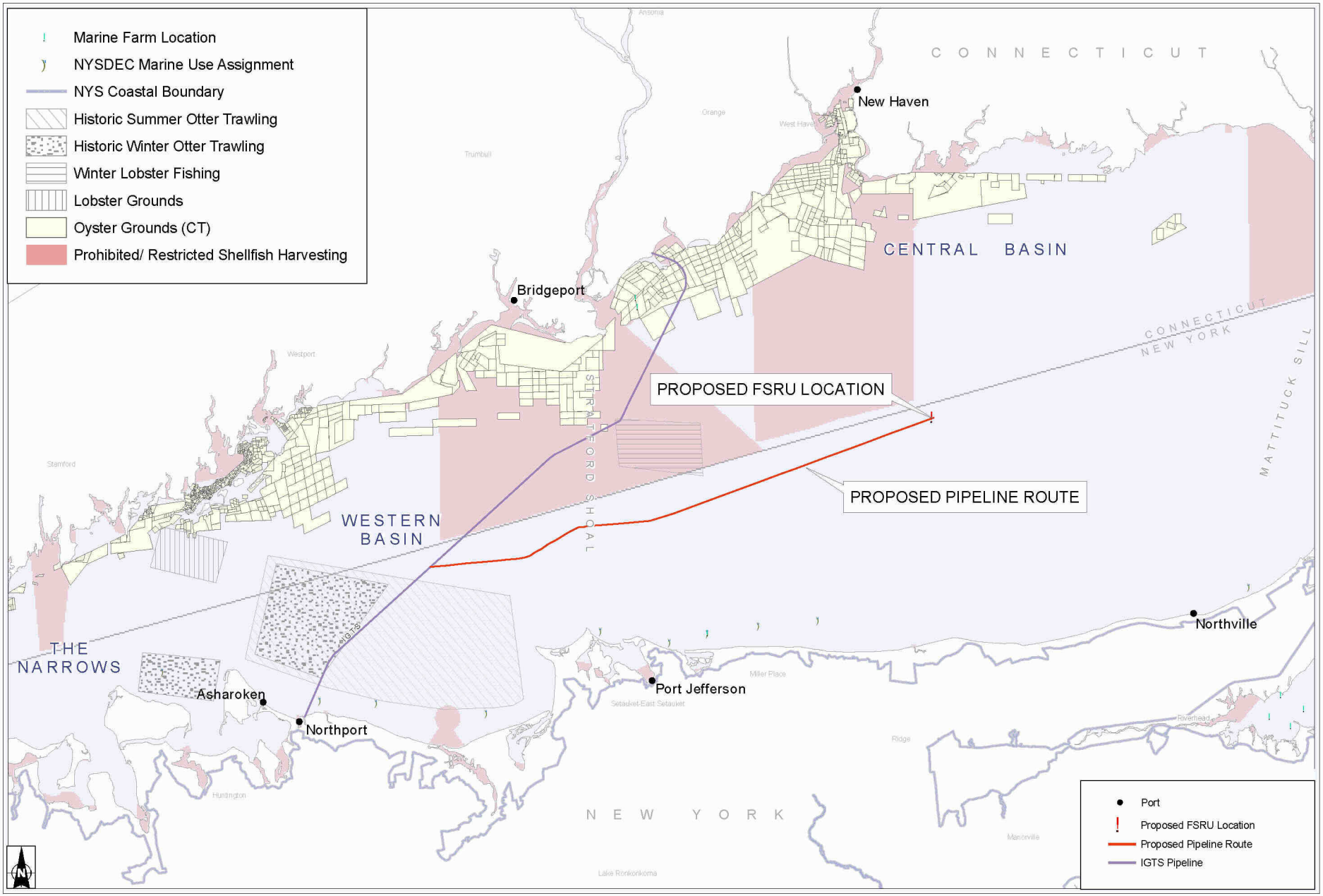
8.3.3 Commercial Fishing/Designated Fishing Grounds

The commercial fishing industry provides many jobs and contributes millions of dollars to the economies of New York and Connecticut. It will be necessary to coordinate commercial fishing activities and the construction and operation of the Project to avoid or reduce interference with these activities. The siting of the Project has taken into account the verified fishing interests to ensure continued access to the historic fishing grounds in the Sound to the extent practicable. Due to the widespread presence of lobster fishing throughout the Sound, it is not feasible to entirely avoid impacts on this industry. However, Broadwater continues to closely coordinate with the lobster industry to minimize impacts. Commercial fishing is discussed in greater detail in Section 8.6.1.

Long Island Sound has numerous areas that traditionally have been high-use fishing grounds and fishery areas. Shellfishing tends to predominate in the shallower nearshore Connecticut waters, while lobster fishing and finfishing predominate in the deeper central portions of the Sound. Whereas the nearshore shellfishing grounds are established through defined leases with the states, the finfish, scallop, and lobster industries tend to operate under informal agreements with regard to specific areas fished. Much of the Connecticut coastline is designated for oyster and clam leases (*see* Figure 8-7). In New York, the New York State Department of Environmental Conservation (NYSDEC) has designated offshore areas in Long Island Sound as Marine Use Assignment Areas, which are located close to the New York shoreline, away from both the FSRU and subsea pipeline. Marine Use Assignments are 5-acre parcels within which NYSDEC permits use by shellfishermen for off-bottom culture of shellfish. By locating the Project centrally in the Sound, no impact on the traditional nearshore shellfishing industry is anticipated.

With respect to lobster fishing areas in Long Island Sound, historical use maps of the Sound prepared by the Connecticut Department of Environmental Protection (CTDEP) indicate that nearly all of the western two-thirds of the Sound, including the area being considered for the FSRU and pipeline, is classified as a high-use lobster fishery area (*see* Figure 8-8). Although lobstermen are required to renew permits on a yearly basis, the state agencies do not provide leases for particular portions of the Sound. Rather, territories have been determined largely through historic usage and informal agreements between the fishermen.

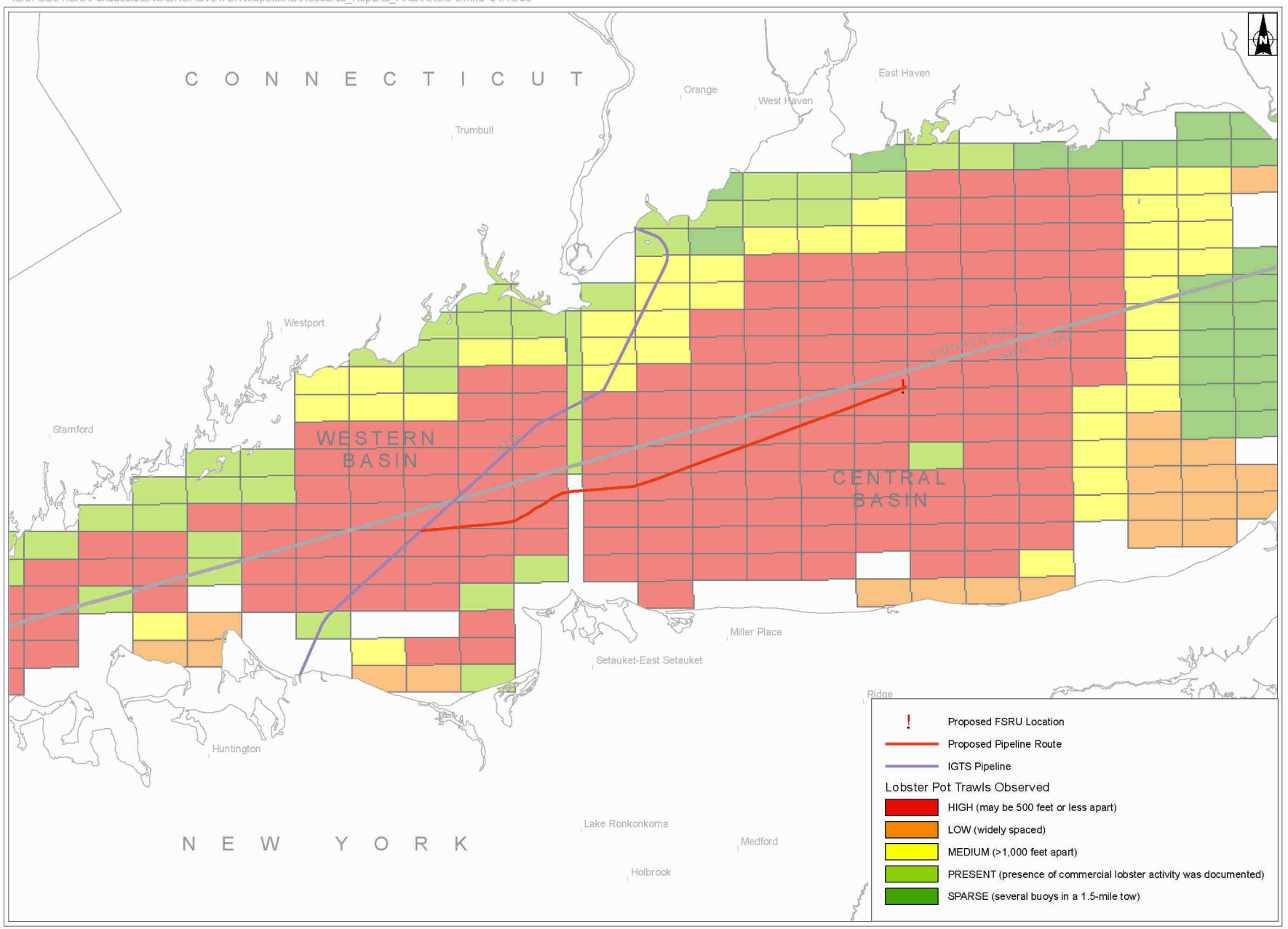
Coordination will be necessary between commercial fishing activities and the Broadwater Project to avoid or minimize interference between fishing and construction and operation of the Project. During construction, portions of the route occupied by pipe laying vessels and related safety zones will be temporarily unavailable for commercial fishing. Construction is scheduled to occur during the winter months, which will minimize impacts on commercial fishing. The areas from which fishing will be excluded will be relatively small and the exclusion period will be relatively brief since pipe laying and lowering are expected to proceed at an overall rate of approximately 1 mile a day. The



Source: U. S. Geological Survey Open-File Report OFR 00-304, 2000,
U. S. NOAA Electronic Nautical Charts.

0 2.5 5 10
Miles

Figure 8-7 Commercial Fishing / Designated Fishing Grounds



Source: Connecticut Department of Environmental Protection, 2004.

0 2.5 5 10
Miles

Figure 8-8 Lobster Pot Densities in the Project Area

construction areas will be visible and will be patrolled by security vessels, which will enable commercial fisherman to avoid fishing in the Project area. Broadwater has undertaken a significant outreach program with the commercial fishing industry, which will continue throughout construction, ensuring that fisherman will be able to remove fixed fishing gear ahead of construction activities. Commercial fisherman will be notified and requested to deploy gear away from construction for certain periods of time. With the exception of the portion of the pipeline that falls within a USCG-designated safety and security zone, there will be no restriction on fishing associated with the pipeline during its operation.

In addition to direct contact with the fishermen, Broadwater will coordinate with the USCG, and a Notice to Mariners will be issued with installation details. Communication will be on-going between construction vessels and all commercial fishing vessels in proximity to the Project area.

Impacts on the commercial fish and lobster stock are expected to be short-term due to the primarily silty, clay, and sandy substrates that are traversed by the Project. The presence of silty, clay, and sandy substrates will allow bottom substrates to re-colonize and reestablish to pre-construction conditions within a relatively short time following completion of construction,

Installation of the FSRU will result in some impacts on the commercial fishing industry. Some impacts on recognized trawl lanes may occur, with the extent largely determined by the USCG's safety and security zone to be established for the Project. The location of the FSRU will also result in impacts on a few lobstermen who deploy lobster pots in proximity to the proposed FSRU location. For safety and security purposes, Broadwater expects that a zone will be established by the USCG around the FSRU. Based on the fishery outreach program conducted by Broadwater, up to five fishermen could lose a portion of their historic fishing grounds. To the extent that these fishermen are unable to adequately mitigate these impacts through fishing in other areas or are precluded from fishing in adjacent areas, there could be a small reduction in industry employment levels and a consequent loss in fishing incomes. To the extent that these fishermen are not able to be absorbed by other industries in coastal areas, there could potentially be a small, negligible loss of output for the coastal economy. Broadwater will continue its outreach program for the commercial fisheries industry throughout the development of the Project. Broadwater will provide appropriate compensation to fishermen directly impacted by the establishment of a USCG-designated safety and security zone. Broadwater will interact directly with the affected fishermen to provide adequate compensation for a demonstrated loss of fishing grounds.

Broadwater proposes to implement the following measures to minimize impacts on the fishing industry within Long Island Sound:

- Construct the marine pipeline and install the FSRU during the winter months (October through April);

- Notify the Lobsterman's Associations and finfishermen of the exact location of the proposed facilities prior to construction using Loran system and GPS coordinates;

- Provide the commercial fishing industry with the size of the construction equipment and anticipated construction schedule, including daily updates, to facilitate movement of fishing gear prior to construction; and

- Utilize local resources to act as spotters during all construction activities to monitor any damage to fishing gear and identify equipment that may need to be removed from within the construction area.

8.3.4 Dumping Grounds

Several active and inactive dumping grounds are located in Long Island Sound. The active dumping grounds include the Central Long Island Sound Disposal Site, the Cornfield Shoals Disposal Site, and the Western Long Island Sound Disposal Site. All of these sites are located in Connecticut waters. No portion of the proposed Project is located within, or in the vicinity of, these disposal sites (*see* Figure 8-6).

Inactive or historic disposal sites include the Southport Historic Disposal Site, the Bridgeport Historic Disposal Site, the Smithtown Historic Disposal Site, and the Port Jefferson Historic Disposal Site. The Port Jefferson Disposal Site, which is located approximately 1 mile (1.6 km) south of the proposed pipeline route, is the disposal site closest to the Project area. The site may have been used for disposal of sediments from Port Jefferson Harbor or other local projects, and any use would have occurred prior to 1977 (Fredette 2005; Gregus 2005). The site is located in an area with an erosional/ non-depostional sedimentary environment. Historic disposal sites were located in these areas to allow any dumped sediment to be dispersed by natural hydrology. Based on Broadwater's spring 2005 sampling effort, no evidence of elevated contamination was identified within the identified Port Jefferson Disposal Site. No other known historic disposal sites are located within the area affected by the proposed Project.

Based on the current Project alignment, no impacts on or from dump sites are anticipated.

8.3.5 Shipwrecks

Based on information obtained from the NOAA Automated Wreck and Obstruction Information System, there appear to be several identified wrecks in the general Project area, the majority of which are in the vicinity of the Stratford Shoal Middle Ground Area. In March and April 2005, Broadwater conducted a preliminary survey that included bathymetry, side-scan sonar, and magnetometer studies to develop a route for the proposed pipeline.

No ship wrecks are located within the central construction corridor. Within the proposed anchor spread, a total of nine anomalies were identified that could potentially be significant cultural resources. During construction, safety and security zones will be established around each of these targets and midline buoys will be used to avoid impacts

on these targets. As such, no impacts on shipwrecks, or any potentially significant cultural features, are expected. Resource Report 4, Cultural Resources, provides complete details of the archaeological investigations completed for the Project.

8.3.6 Lightering Zones

Lightering zones are designated locations for anchoring and ship-to-ship transfer operations. Several lightering zones are located in Long Island Sound (*see* Figure 8-6). These lightering zones were identified by reviewing current NOAA navigation charts for the Sound.

The lightering zones closest to the proposed FSRU include one located south of East Haven, Connecticut, in Connecticut waters, and one located north of Riverhead, New York, in New York waters. The lightering zone south of East Haven, which is closest to the FSRU, is more than 2.5 miles (4 km) from the proposed facility location.

The lightering zones closest to the proposed pipeline include one located north of Port Jefferson, New York, in New York waters, a zone north of Fort Salonga, New York, in New York waters, and a zone located south of Bridgeport, Connecticut, in Connecticut waters (*see* Figure 8-6). The zone north of Port Jefferson, which is closest to the proposed pipeline route, is approximately 0.5 mile (0.8 km) from the proposed facility location.

No direct impacts on any of these areas are expected. Indirect impacts may include temporary rerouting of vessel traffic into these areas during construction activities. All appropriate notifications will be made, and standard marine practices and precautions will be followed so as not to interfere with anchoring or lightering activities.

8.3.7 Vessel Traffic

Vessel traffic in Long Island Sound includes commercial shipping, recreational boating, ferry services, and sightseeing tours. Each aspect of vessel traffic in the Sound is discussed below.

8.3.7.1 Commercial Shipping

Foreign commercial shipping in the Project area mainly involves vessels arriving and departing the ports of Northport and Asharoken, New York, and Bridgeport and New Haven, Connecticut. In addition to these ports, Port Jefferson's domestic shipping is significant, but this port cannot support deeper-draft vessels. As mentioned previously, in the absence of a traffic routing scheme in Long Island Sound, federal navigational aids and standard marine practices have led to the development of established traffic patterns and generalized shipping routes in the Sound. The main shipping route runs generally down the center of the Sound on a straight course from deepwater areas in the eastern Sound to the deepwater pass through Stratford Shoal, with a secondary shipping route trending from northeast to southwest toward Northport, New York. Traffic branches off to enter deepwater ports (*see* Figure 8-5). Broadwater located the proposed FSRU outside of this traffic pattern specifically to avoid and minimize impacts on commercial shipping.

Information on commercial vessel traffic from USACE was gathered and analyzed in consultation with the USCG Vessel Traffic Service New York, New York Pilots, and USACE. Domestic and foreign traffic were addressed, but fishing vessels and escort tugs were not included. Each of the deepwater ports receives transit tankers that are similar in size to LNG carriers. Tankers using New Haven, Bridgeport, and Northport are known to carry oil and petroleum products as well as other chemicals. Cargo vessels using Asharoken, New London, and Northville likely contain oil, petrochemicals, and other chemicals.

Table 8-3 presents 2003 commercial vessel traffic counts for deepwater ports in Long Island Sound as provided by USACE. Ports and traffic routes are depicted on Figure 8-5.

Table 8-3 Commercial Vessel Traffic in Long Island Sound (2003)

Deepwater Ports[1]	Vessel Trips per Year	Transit Tankers
Bridgeport, CT	21,588	27
New London, CT	10,564	10
New Haven, CT	3,603	469
Port Jefferson, NY[2]	21,943	—
Northville, NY	1,207	31
Asharoken, NY	282	11
New York, NY[3]	50	50
Northport, NY	24	Unknown

Source: USACE 2005.

1 Foreign and domestic traffic were totaled for deepwater ports; fishing vessels and escort tugs were not included.

2 Vessel traffic received at Port Jefferson is significant; however, vessels range in size from less than 500 gross registered tons (GRT) to 25,000 GRT. Two transit tankers were noted in the overall traffic numbers that are likely similar in appearance to an LNG carrier. However, they are much smaller in size.

3 While 21,789 vessels were reported for New York Harbor, the majority of these vessels do not approach through Long Island Sound due to strong currents.

In May 2005, a Ports and Waterways Safety Assessment (PAWSA) was conducted for Long Island Sound in which the USCG provided vessel arrival data for the significant harbors in Long Island Sound. The PAWSA was conducted to understand and address issues associated with waterway risks and potential intervention actions to avoid waterway risks, including the Broadwater Project. The process involved gathering together a select group of waterway users and stakeholders to evaluate waterway risk factors in Long Island Sound and the effectiveness of various intervention factors.

The PAWSA-generated data differ from the USACE-derived data in that only vessels required to provide a Notice of Arrival under the Vessel Traffic Service are included, making this a subset of the total vessel traffic. Broadwater will not enter the mandatory

reporting area for the Vessel Traffic Service as this area does not extend into Long Island Sound or Block Island Sound. Ports and traffic routes are indicated on Figure 8-5. Table 8-4 presents the PAWSA vessel arrival data since the beginning of 2003.

Table 8-4 PAWSA Vessel Arrival Data

Location	Total Number	Barge	Freight Ship	Passenger Ship	Tank Ship	Towing Vessels	Other
2005 (through April 21)							
Bridgeport	139	110	22	0	2	0	5
Bridgeport Anchorage	9	2	7	0	0	0	0
Groton/New London	77	34	11	18	5	1	8
New Haven	266	193	26	0	30	9	8
Stamford	35	15	0	0	20	0	0
Long Island (North Shore)	53	11	0	1	40	0	1
Northport	14	10	0	0	4	0	0
Riverhead	94	74	0	0	20	0	0
Total	**687**	**449**	**66**	**19**	**121**	**10**	**22**
2004							
Bridgeport	363	246	86	3	13	0	15
Bridgeport Anchorage	22	1	20	0	0	0	1
Groton/New London	190	64	34	58	11	3	20
New Haven	164	474	81	0	140	27	42
Stamford	60	29	0	1	29	0	1
Long Island (North Shore)	141	55	0	1	72	0	13
Northport	54	31	0	0	18	0	5
Riverhead	270	199	0	0	70	0	1
Total	**1,264**	**1,099**	**221**	**63**	**353**	**30**	**98**
2003							
Bridgeport	312	189	103	5	14	0	1
Bridgeport Anchorage	18	3	12	0	3	0	0
Groton/New London	151	64	33	37	9	0	8
New Haven	673	279	95	5	242	14	38
Stamford	58	21	0	0	37	0	0
Long Island (North Shore)	122	50	1	5	60	0	6
Northport	59	36	0	0	19	0	4
Riverhead	207	150	2	0	53	0	2
Total	**1,600**	**792**	**246**	**52**	**437**	**14**	**59**

Source: USCG 2005.

No significant, permanent impacts on commercial shipping from installation or operation of the subsea pipeline are expected. Installation of the pipeline will be completed in an approximately 6-month time frame between October and April. Although the pipeline

construction route will infringe temporarily on the shipping route approaching Bridgeport (*see* Figure 8-5), due to the linear nature of the project, the installation activity and associated construction barges, boats, and tenders move along the route and do not stay in one place for long. The offshore areas allow for movement of commercial vessels from one place to another so that commercial shipping can be ongoing in other areas, as the project installation moves across the Sound. Constant communication between construction vessels and other commercial traffic will ensure that adequate safety margins are maintained. There is an established performance history associated with constructing subsea utilities within Long Island Sound. This includes natural gas pipelines, submarine electric transmission cables, and submarine fiber-optic cables. All of these projects required effective communication between construction vessels and other commercial and recreational vessels within the Sound. In the past five years the following projects were successfully constructed: Eastchester Expansion Pipeline Project, the Cross Sound Cable, and the Flag Atlantic-1 North fiber optic cable.

8.3.7.2 Recreational Boating

Long Island Sound is a popular recreational boating area. During construction of the proposed pipeline facilities, there will be temporary and minor loss of recreational boating area in the immediate vicinity of the active work area. Because installation will occur primarily during the winter months, when use of the Sound by recreational boaters is reduced, impacts on recreational boating are minimized. Therefore, installation of the facilities is expected to have only minor impacts on recreational boating. During operation, the proposed pipeline will have no effect on recreational boating due to its installation beneath the seafloor.

Broadwater has proposed to site the FSRU in the central portion of the Sound, in the widest portion of the Sound, approximately 9 miles (14.5 km) from the New York shoreline and 10 miles (16.4 km) from the Connecticut shoreline. This will avoid potential impacts on smaller watercraft that typically navigate much closer to shore. By centrally locating the facility in the Sound, recreational vessels will have ample room to maneuver around the facility. In addition, the FSRU has been located so that it is not directly between larger ports, thereby eliminating impacts on direct routes of travel between those ports. As discussed below, several regattas were identified that are routed in proximity to the proposed FSRU location. For security reasons, a safety and security zone will likely be established by the USCG. As such, it may be necessary to reroute regattas to avoid the FSRU and any associated safety and security zone. Because the facility is located more than 9 miles (14.5 km) from shore in the widest portion of the Sound, the impact of rerouting regattas will not be significant.

The extent and specific restrictions associated with the potential safety and security zone will be established by USGC as part of their evaluation of the Project. Long Island Sound encompasses nearly 1,300 square miles (3,370 km^2). Any safety and security zone established by the USCG would potentially restrict public access from only a very small portion of the Sound. By siting the facility centrally in the Sound, impacts are minimized, with no significant public access limited by the Project.

Boat Surveys

To supplement and expand on literature research and interviews with local resources, Broadwater performed a boat traffic survey in the summer of 2005 to observe commercial and recreational boat traffic patterns in the vicinity of the proposed Project (*see* Appendix B). Based on the results of the survey, Broadwater assessed the potential impacts resulting from construction and operation of the FSRU and pipeline on commercial and recreational boating activities in Long Island Sound.

The objective of the boat survey was to quantify boat use in the area of the proposed Project during holiday weekends and other high-use days during the summer to observe the maximum boat traffic near the proposed FSRU location and along the proposed pipeline route. High-use days included days where sailing regattas and excellent weather coincided, which often overlapped with holiday weekends.

The major findings of the boat traffic survey included the following:

- The majority of boats observed during the surveys were recreational power and sailboats, with significantly more recreational boat traffic later in the summer season coinciding with warmer air and water temperatures.

- Over the course of the summer boat surveys, 329 boats were observed along the proposed pipeline route and in the vicinity the FSRU site. Of these, 81 boats were observed within 0.6 mile of the proposed FSRU location and 62 boats were observed between 0.6 and 1.5 miles of the proposed FSRU location, an insignificant number in comparison to the number of recreation vessels that utilize Long Island Sound.

- The most frequently observed boat size, comprising 56.2% of all boats surveyed, was Class 3 (30 to 45 feet), with 44.3% of the Class 3 boats being recreational sailboats. The second most frequently observed boat size was Class 2 (15 to 30 feet), comprising 31.3 % of all boats observed.

- High densities of boats were consistently recorded in proximity to the Stratford Shoal. A large number of fishing charters and private recreational fishing boats trolled the Stratford Shoal area, which can be attributed to the change in benthic topography and shallower water, which provide excellent habitat for fisheries. No commercial fishing vessels were observed in proximity to the proposed FSRU location.

- Large commercial vessels, which were primarily observed traveling east-west, utilized established shipping routes to the north and south of the FSRU and thus should not be impacted by the current siting of the FSRU.

As mentioned previously, scheduling LNG carrier arrivals will take into account use of the area by other marine traffic and will require close cooperation between Broadwater, the USCG, pilots, and other operators to ensure impacts on other users of the Sound are

limited. An LNG carrier traversing the Race and the Sound will likely be surrounded by a traveling, USGC-imposed safety and security zone, which may limit use of the area adjacent to the carrier. It is important to note that, based on an anticipated carrier speed of 12 knots, the approximate duration of a traveling safety and security zone at any single point would be only approximately 15 minutes. Based on review of existing NOAA charts, the transiting LNG carrier would not result in any bottlenecks that would prevent other commercial or recreational traffic from transiting the Race

In addition, the USCG Captain of the Port (COTP) has publicly indicated that there is sufficient room within the Race for recreational/commercial vessels with significantly less draft than the LNG carriers to also maneuver through the Race. Navigational restriction of the Race is likely to only temporarily impact other similar deep-draft vessels that are required to use the central and deepest portion of the entrance to Long Island Sound.

Regattas

Numerous regattas are held in Long Island Sound during the boating season, some of which transit the central portion of the Sound and many of which do not. According to representatives interviewed from local yacht clubs, the following races were identified as major regattas:

- **Block Island Race Week, June 19-25, 2005.** The Block Island Race Week consists of four fleets and 29 races off Rhode Island's Block Island. The race has no specific course but is raced on 2 to 3 mile courses in Block Island Sound.

- **Stratford Shoal Race, July 2, 2005.** The Stratford Shoal Race originates at the Riverside Yacht Club in Riverside, Connecticut. In 2005, the race had two courses, with the starting line for each located off Flat Neck Point, southeast of Greenwich, Connecticut. The first course was the Stratford Shoal Light Course, which runs 45 miles. The second course was the Cable & Anchor Course, which runs 27 miles.

- **Around Long Island Regatta, July 28, 2005.** This regatta is a race that originates near Brooklyn, New York, heads along the southern Long Island shore past Jones Beach and Shinnecock Inlet, up the eastern end of Long Island to Orient Point, and finishes near Glen Cove. The race occurs over a 24-hour period and does not transit the central portion of the Sound.

- **Vineyard Race, Labor Day weekend.** This 238-mile course runs from Shippan Point, through the central portion of the Sound, through the Race, past Block Island, and on to the light tower at the entrance to Buzzard's Bay, returning back from Block Island en route to the finish in Stamford Harbor, in Stamford, Connecticut.

In addition to these larger Sound-wide regattas, many additional regattas and races take place on a much more localized basis. Local sailing events typically are held in proximity to the clubs sponsoring the events and are limited to areas nearer shore.

8.3.7.3 Ferry Routes

Several ferry services operate year-round in Long Island/Block Island Sound, and coordination between the Project and potentially affected ferry operators began during the USCG's Ports and Waterways Safety Assessment Workshop. Broadwater has been actively engaged with ferry operators throughout this Project. The potentially affected ferry routes include the following (*see* also Figure 8-4):

- Port Jefferson, New York, to Bridgeport, Connecticut;
- Orient Point, New York, to New London, Connecticut (ferry/passenger jet);
- New London, Connecticut, to Montauk, New York;
- Point Judith, Rhode Island, to Block Island, Rhode Island (ferry/high-speed ferry);
- Block Island to Newport, Rhode Island
- Montauk, New York, to Block Island, Rhode Island; and
- New London, Connecticut, to Block Island, Rhode Island.

Port Jefferson, New York, to Bridgeport, Connecticut

The Port Jefferson-to-Bridgeport ferry makes 36 daily crossings. The schedule runs on 6 A.M. to 10 P.M. departure times in both summer and winter. This ferry operates approximately 16 miles west of the proposed FSRU and will traverse the marine pipeline route. Mooring and operation of the FSRU are not expected to impact this ferry service.

Installation of the subsea pipeline will have some minor, temporary impact on the Port Jefferson-to-Bridgeport ferry service. Due to the linear nature of the Project, the installation activity and associated construction barges, boats, and tenders will move along the route and not stay in one area for long. During construction operations, Broadwater will closely coordinate schedules with the ferry operator to provide for minimal disruption to the ferry schedule. Once the pipeline has been installed, no impact will occur as a result of operation of the pipeline.

Orient Point, New York, to New London, Connecticut

The Orient Point-to-New London route makes 30 to 35 daily crossings, with numbers varying daily and weekly. During the winter, the number of daily crossings decreases to 20 to 25. The schedule returns to normal in March/April. In addition, the Orient Point-to-New London passenger jet makes 12 daily crossings in the summer and eight in the winter.

The ferry route from Orient Point to New London is more than 40 miles (64 km) east of the proposed FSRU location. No impact on these ferry operations are expected as a result of mooring and operation of the proposed FSRU or construction and operation of the proposed pipeline.

New London, Connecticut, to Montauk, New York

A ferry runs from New London, Connecticut, to Montauk, New York. No detailed service information was available for this route.

Block Island Ferries

In addition to the routes discussed above, a number of designated ferry routes run between New York, Connecticut, and Rhode Island and Block Island. The Block Island ferries are more than 40 miles (64 km) east of the proposed FSRU location and will not be impacted by the proposed FSRU; however, as mentioned previously, operation of the proposed Project has a potential to impact ferry service outside of Long Island Sound as a result of incoming LNG carriers transiting into Long Island Sound through the Race from the east. Incoming LNG carriers will unavoidably intersect ferry routes on their incoming and outgoing transit routes. The USCG may require a moving safety and security zone around the incoming carriers for safety and security purposes. While this may result in some minor impact on ferry operations, numerous larger vessels currently access the Sound through the Race, traversing ferry routes. It is anticipated that LNG carriers will be calling on the FSRU every two to three days. Scheduling of LNG carrier arrivals and communications between the ferry operators, the terminal, the USCG, and the harbor pilots bringing the LNG carriers into the Sound will serve to avoid or minimize impacts.

Block Island ferry routes include the following:

Point Judith, Rhode Island, to Block Island, Rhode Island

The Block Island-to-Point Judith ferry makes approximately 18 daily crossings in the summer (July 2 to September 4) and two to six crossings in the winter (October to March).

Block Island to Newport, Rhode Island

This ferry makes two daily crossings.

Montauk, New York, to Block Island, Rhode Island

This passenger ferry will be operated by Viking Ferry Services. It will make two daily crossings from May 27 to October 10. There is no service the rest of the year.

New London, Connecticut, to Block Island, Rhode Island

A high-speed ferry service operates between New London and Block Island. In the summer (June 17 to September 11), this ferry makes eight daily crossings Monday through Wednesday, and ten crossings Thursday though Sunday. From May 27 through

June 12 and September 16 through October 10, this ferry makes eight crossings Friday through Sunday. There is no service the rest of the year.

8.3.7.4 Naval Vessel Traffic

Naval Submarine Base New London is located in Groton, Connecticut (*see* Figure 8-4), and most of the naval vessels operating from New London are submarines. For security purposes, the exact routes of naval submarines are not published and are, therefore, not shown on the figure. Although impacts on naval vessels are not expected, coordination and communication between the Navy and LNG carriers will be required to ensure that scheduling requirements are enforced and there are no safety concerns with these vessels as they transit this area.

8.3.7.5 Sightseeing Tours

A number of touring companies offer sightseeing tours throughout Long Island. Tours are mainly given in nearshore areas and do not generally traverse the central portion of the Sound. Broadwater proposes to construct the Project during late fall and winter, when sightseeing tours are inactive. Operation of the proposed pipeline will not impact sightseeing tours, since the pipeline will be buried beneath the seafloor. Specific issues associated with visual impacts on on-water uses will be discussed and evaluated in the VRA.

8.4 COMMERCIAL AND RECREATIONAL FISHING

8.4.1 Commercial Fishing

The commercial fishing industry, which involves all portions of Long Island Sound, provides many jobs and contributes millions of dollars to the economies of both New York and Connecticut. Commercial fishing in the Sound targets both finfish and shellfish (including bivalves and the American lobster). Hard clams and Eastern oyster are the most actively fished commercial species in the region, accounting for more than 74% of the total revenues in 2001. Shellfishing takes place in open waters and aquaculture environments, with aquaculture taking place in beds off both the New York and Connecticut coasts. Historically, the lobster fishery was a significant part of the shellfish industry in the Sound; however, lobster catches have decreased significantly in recent years because of a die-off that began in 1998. Finfishing also takes place throughout the Sound, although trawl fishing is limited because of the density of lobster pots throughout the Sound. By locating the proposed Project in the central portion of the Sound, impacts on bivalves are avoided.

Despite the lobster die-off that has occurred in recent years, the Project area is heavily fished for lobsters. Lobstermen deploy lines of traps, with numerous traps on each line. The traps are deployed for several days and are reset after the catch is collected. For the years leading up to the die-off, lobstermen landed an average of 10 million pounds (4.5 million kilograms) of lobsters per year, with a total value of $32 million annually. Since the die-off, the landings have fallen to 1.44 million pounds (650,000 kg), and the value has declined to approximately $5.1 million. Since the die-off, several lobstermen have chosen to pursue finfish and shellfish after modifying their vessels and gear, while others

dropped out of the industry. Table 8-5 summarizes the top five commercial fish landings, in terms of dollars, for New York and Connecticut for the years 2002 and 2003.

Based on information obtained from local fishermen and available fishery data, the transitional and mud bottoms of the Sound attract a high number and diversity of fish. Information obtained from local fishermen, however, indicates that nearly the entire western two-thirds of the Sound, including the area being considered for the FSRU and pipeline, is a high-use lobster fishery area. Because of the high density of lobster traps in New York waters throughout the central and western basins of the Sound, finfishing is limited within the Project area.

Broadwater has undertaken a fishermen's outreach program for the proposed Project in order to identify interested parties that utilize the Sound for commercial and recreational fishing and to identify those that may be impacted by the Project. Information obtained from commercial and recreational fishermen through a telephone survey includes: areas fished in Long Island Sound, targeted species, gear type, seasons fished, and concerns related to the proposed Project. The outreach program also included review of information provided by NOAA Fisheries related to catch in the Project area.

Table 8-5 Top Five Commercial Fishing Landings, in Terms of Dollars, for New York and Connecticut (2002)

Location Species	Pounds	Value	Price per Pound
New York			
Quahog clam	1,501,752	$12,244,654	$8.15
Longfin squid	9,613,411	$6,246,554	$0.65
Atlantic surf clam	8,543,690	$5,519,822	$0.65
American lobster	1,440,483	$5,131,295	$3.56
Eastern oyster	536,958	$4,994,990	$9.30
Connecticut			
Quahog clam	3,434,844	$9,202,241	$2.70
Sea scallop	1,578,640	$6,399,897	$4.05
American lobster	1,067,121	$4,225,522	$3.96
Eastern oyster	246,669	$2,012,161	$8.16
Longfin squid	1,778,266	$1,178,428	$0.66

Source: NOAA Fisheries 2005.

Top Five Commercial Fishing Landings, in Terms of Dollars, for New York and Connecticut (2003)

Location Species	Pounds	Value	Price per Pound
New York			
Quahog clam	1,552,946	$12,399,024	$7.98
Atlantic surf clam	13,263,570	$7,934,420	$0.60

Top Five Commercial Fishing Landings, in Terms of Dollars, for New York and Connecticut (2003)

Location Species	Pounds	Value	Price per Pound
American lobster	946,449	$4,426,316	$4.68
Longfin squid	4,602,936	$4,353,264	$0.95
Eastern oyster	466,117	$4,262,701	$9.15
Connecticut			
Quahog clam	4,038,021	$10,469,996	$2.59
Sea scallop	1,907,675	$8,124,639	$4.26
American lobster	671,119	$3,170,088	$4.72
Eastern oyster	279,414	$2,273,760	$8.14
Silver hake	2,453,756	$1,460,245	$0.60

Source: NOAA Fisheries 2005.

The majority of interviewed commercial fishermen (> 90%) target lobster with fixed gear (lobster pots/traps). This corresponds with reports of lobster fishing dominating the commercial fishing industry in Long Island Sound. Approximately half of the lobster fishermen target only lobster and half also harvest finfish, either as by-catch or by fishing with fixed gear such as fish pots and nets. Trawling (dragging) activities are limited in Long Island Sound.

Throughout Long Island Sound, fishing occurs according to territories established through cooperative agreements between and among the fishermen. Lobster fishing and other fishing utilizing fixed gear is ubiquitous throughout the Sound, with very high lobster pot densities in some areas (*see* Figure 8-8). Lobster pots are usually set in a series, with 5 to 15 traps being most common. The pots are strung on a ground line about 60 to 100 feet apart. As depicted on Figure 8-8, buoys marking these lines of lobster pots can be set at intervals of 500 feet or less. Based on an average of 10 pots per line and 500-foot intervals between buoys, lobster pot densities could be as high as 1,000 per square mile. However, given the overall reduction in lobster pots that has occurred in the last 7 years, the actual number of traps set in any given area is likely to be considerably less. NYSDEC estimates that approximately 110,910 lobster traps were set in all of Long Island Sound (including the East End) in 2004 (*see* Table 8-6). Based on this data, 32,336 lobster traps were set in eastern Long Island Sound (where the FSRU would be located) in 2004. This represents a decrease of approximately 76,000 traps from 1998 (i.e., prior to the significant lobster die-off in the Sound) when 108,413 traps were set. This potentially provides an opportunity for impacted lobstermen in proximity to the FSRU to successfully relocate traps without adversely impacting other lobstermen in eastern Long Island Sound.

Table 8-6 Lobster Trap Use Reported on Annual Recall Survey

Year	Western Long Island	Eastern Long Island	East end	Total Long Island Sound
1998	162,457	108,413	28,926	299,795
1999	161,910	102,024	40,447	304,381
2000	81,835	80,065	30,406	192,306
2001	80,708	71,205	24,095	176,007
2002	57,207	65,862	21,556	144,624
2003	40,307	36,011	12,654	88,971
2004	52,971	32,336	25,604	110,910

Source: NYSDEC 2005

Once the size of the safety and security zone surrounding the stationary tower structure/FSRU has been determined by the USCG, an order-of-magnitude estimate of the number of potentially displaced lobster pots and lobstermen can be made by using the lobster density information grid map (*see* Figure 8-8).

The potential displacement area can be estimated by summing the number of square miles within the safety and security zone, assuming a given density of lobster buoys. The area of a safety and security zone surrounding the mooring area/FSRU that would be foreclosed to lobster pots can be measured once the boundary of the zone has been determined. An average buoy density factor can be assigned to this area based on the information presented on the lobster density grid map. An estimate of the number of buoys per square mile, as well as an estimate of the total square miles potentially foreclosed to lobster pots, can then be made.

The average number of lobster pots associated with a buoy can be obtained from the Lobstermen's Association. The average number of lobster pots per buoy can be used with the estimate of the total number of potential buoys to be displaced to estimate the number of total lobster pots within the safety and security zone. The order-of-magnitude estimate can then be compared to the average number of lobster pots deployed by an individual lobster fisherman in the Project's vicinity. This comparison and calculation provides an estimate of the number of potentially impacted lobstermen. The outreach program and close future cooperation with the Lobstermen's Association will corroborate industry figures (e.g., number of buoys and pots) that are generally thought to be reflective of the industry in this region of Long Island Sound.

Assessments of the potential commercial impact on lobstermen and identification of any future mitigation in the form of compensation options have not yet been made. More information is required regarding potential lobster pot displacement resulting from establishment of the USCG safety and security zone before these estimates can be developed.

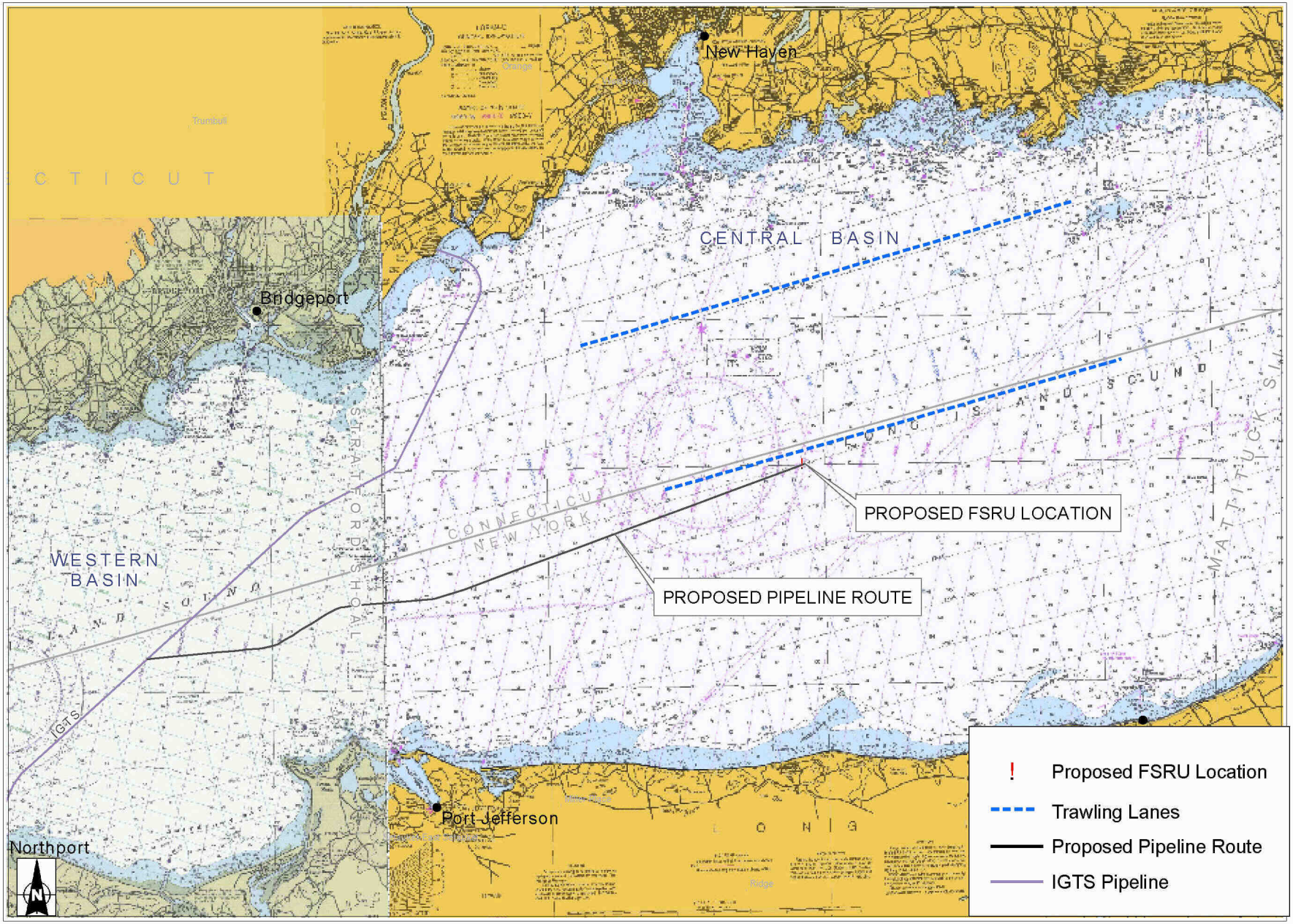
In order to avoid conflict between fishermen using fixed gear and fishermen who trawl, specific areas have been agreed upon as trawling lanes (*see* Figure 8-9). In general,

trawling is limited in the Sound due to the predominance of fixed-gear lobster fishing. These trawling lanes, which were not identified during the preliminary data collection (as presented in Section 8.3 and depicted on Figure 8-6), were identified during the initial consultation with local fisherman and are consistent with information presented in the *Environmental Impact Statement for the Designation of Dredge Material Disposal Sites in Central and Western Long Island Sound, Connecticut and New York* (EPA 2004). Based on the identification of the trawling lane that parallels the New York and Connecticut border, the FSRU may impact an existing trawl lane, with the extent of the impact dependent on the USCG-designated safety and security zone.

Lobster fishermen report fishing 12 months out of the year, with two peak periods, one in the spring/summer (beginning sometime between February and April and continuing through August) and one in the fall/early winter (late October through December). Fishermen who trawl reported fishing from April to June, August to October, and December to January. Trawling does not occur in the area immediately adjacent to the FSRU; however, depending on the size of the USCG-established safety and security zone, existing trawling areas may fall within the zone established for the FSRU (*see* Figure 8-9). Table 8-7 provides a summary of the species fished, gear type, and fishing periods reported by fishermen interviewed during the survey.

Table 8-7 Species Fished, Gear Used, and Fishing Periods

Species Fished	Gear	Fishing Periods
Lobster	Lobster traps/pots	12 months (beginning sometime between February and April and continuing through August, and in late October through December; peak in the spring/summer).
Primary lobster by-catch: tautog (blackfish), black sea bass	Lobster traps/pots	
Other lobster by-catch: scup (porgies), conch, squid, summer flounder	Lobster traps/pots	
Tautog (blackfish)	Fish pots	
Conch	Conch pots	
Scup (porgies), summer flounder, tautog (blackfish), bluefish, striped bass, squid, flounder, and butterfish	Fish traps, nets, hook and line	12 months (target species change with seasons)
Scup (porgies), summer flounder, tautog (blackfish), bluefish, striped bass, squid, flounder, and butterfish	Trawl	Focused efforts from April to June, August to October, and December to January (target species change with seasons)



Source: Trawl Lane Locations (Loran Lines 43970 to 43973, 15070 to 15 Miles East, New York and Loran Lines 44010 to 44012, 15080 to 14955, Connecticut) provided by Broadwater Stakeholder Team, 2005,
U. S. Geological Survey Open-File Report OFR 00-304, 2000,
U. S. NOAA Electronic Nautical Charts.

Figure 8-9 Trawling Lanes in the Project Area

The main concerns reported by fishermen interviewed include: timing of installation with respect to peak fishing periods and the loss of fishing grounds, as well as associated loss of income; potential disruption of cooperative agreements; and encroachment on the territory of other fishermen. The concerns reported by fishermen interviewed are listed in Table 8-8. The full finfishery outreach report is included as Appendix C. Broadwater will maintain an open dialogue with fishermen throughout development of the Project to avoid or minimize impacts as much as possible. The actual extent of impact on an individual fisherman cannot be fully assessed until after the USCG has identified a proposed safety and security zone for the FSRU. Following establishment of the safety and security zone, Broadwater will coordinate with each potentially impacted fisherman to determine adequate compensation for demonstrated loss of fishing income resulting from implementation of the Project.

Table 8-8 Fishermen Potentially Affected by the Proposed Project and Their Concerns

	Fishermen Working in the Proposed FSRU Terminal Area	Fishermen Working in the Pipeline Area or General Project Area	Fishermen Working Outside of the Project Area
Main Concerns	Loss of fishing grounds with no room for adjustments. Loss of income and compensation.	Timing of pipeline construction, i.e., peak fishing time. The loss of income if gear has to be pulled Ripple effect of the loss of fishing grounds in the area of the proposed LNG terminal and associated buffer zone.	Encroachment on fishing areas due to displacement from the terminal area. Security zones around LNG carriers.
Other Concerns	Potential accidents and impacts on the fishery.	Bottom disturbance during construction. A potential accident in the Sound.	

During construction, portions of the route occupied by pipeline construction vessels will be temporarily unavailable for commercial fishing. Construction is scheduled to occur during the winter months, which will minimize impacts on commercial fishing. The areas from which fishing will be excluded will be relatively small, and the exclusion period will be relatively brief since pipe laying, lowering, and, where required, backfilling are expected to proceed at an overall average rate of approximately 1 mile a day.

Impacts on the commercial fish and lobster stocks are expected to be short term. The primarily silty, clay, and sandy substrates that are traversed by the Project will allow for recolonization and reestablishment to preconstruction conditions within a relatively short time following completion of construction.

Some fishermen may be temporarily negatively impacted during the construction period. To the extent that these fishermen are precluded from fishing in adjacent areas and they are unable to mitigate these potential temporary impacts by fishing in other areas during

this brief interruption, fish landings and lobster yields may decline in the short term. Without mitigation efforts and with fewer landings, a small number of fishermen may temporarily experience lower incomes. Broadwater will work individually with impacted fishermen to develop adequate compensation for demonstrated lost fishing opportunity or gear.

The construction areas will be visible and patrolled, which will alert commercial fishermen to avoid the Project area. Broadwater's outreach program with the commercial fishing industry, which will continue throughout the construction period, will help ensure that fishermen will be able to remove fixed fishing gear ahead of construction activities. Commercial fishermen will be notified and requested to deploy gear away from construction areas for certain periods of time. Consistent with its efforts to coordinate with other large vessels in the Sound during construction, in addition to direct contact with the fishermen, Broadwater will coordinate with the USCG, and a Notice to Mariners will be issued with installation details. Communication will be on-going between construction vessels and all commercial fishing vessels in proximity to the Project area.

Installation of the FSRU will result in some impacts on the commercial fishing industry. The location of the FSRU will result in impacts on a few lobstermen who deploy lobster pots in proximity to the proposed FSRU location, and impacts on commercial trawling may be impacted based on the size of the safety and security zone to be established by the USCG. All non-Project-related vessel traffic will likely be restricted from the safety and security zone established by the USCG around the FSRU.

Operation of the FSRU is anticipated to have minimal effect on fishing industry employment levels. Based on the fishermen outreach program conducted by Broadwater, up to five fishermen could lose some portion of their historic fishing grounds. To the extent that these fishermen are unable to adequately mitigate these impacts through fishing in other areas, there could be a small reduction in industry employment levels and a consequent loss in fishing incomes. If the affected fishermen are not able to be absorbed by other industries in coastal areas, there could potentially be a small loss of output for the coastal economy. Broadwater will work individually with impacted fishermen to develop adequate compensation for demonstrated lost fishing opportunity or gear.

Until the USCG identifies a specific safety and security zone for the facility, the extent of actual long-term impacts cannot be assessed. Broadwater will continue its outreach program for the commercial fishing industry throughout development of the Project.

A comparison of the economic impacts associated with the Broadwater Project with the economic impacts associated with construction of other subsea utilities (e.g., the IGTS pipeline, the Cross Sound Cable, and the IGTS Eastchester Extension) indicates a number of differences in overall impact for several reasons. The main difference between the Broadwater Project and projects such as the IGTS mainline between Connecticut and Long Island, the Cross Sound Cable, and the IGTS Eastchester Extension from Northport, Long Island, to the South Bronx is the nature of the habitats potentially

impacted. All three of those projects required nearshore and shoreline crossings that posed potential threats to species dependent upon shallow-water estuarine habitats located adjacent to the pipelines.

Compared to the Broadwater Project, those three projects placed greater potential stress on more organisms at formative stages of their life cycle (i.e., eggs and larvae) because of their traversal of the species' spawning and breeding grounds in the inshore coastal portion of Long Island Sound. The potential interruption of the life cycle would impact adult species of commercial importance, which would be expected to impact future commercial landings. In addition, due to the traversing of shallow-water habitats, the other utilities directly impact shellfish beds, which are restricted to shallower coastal waters.

In contrast, the Broadwater Project will not traverse any coastal beach habitat or estuary and will be located in deep water. Instead of numerous species being potentially impacted during critical life stages, the main commercial species likely to be impacted will be lobster.

Unlike the other utility projects, the Broadwater Project will result in some long-term impact on the lobster industry due to the anticipated establishment of a safety and security zone by the USCG in proximity to the FSRU. As previously indicated, upon identification of the extent of the USCG-assigned safety and security zone, Broadwater will work individually with affected fishermen to develop adequate compensation for demonstrated lost fishing opportunity.

8.4.2 Recreational Fishing

Charter boat companies and private individuals use Long Island Sound as a recreational fishing area. Important recreational fisheries include flounder, bluefish, scup (porgies), striped bass, tautog (blackfish), and weakfish. Broadwater undertook a fishermen's outreach program for the proposed Project in order to identify interested parties that utilize the Sound for commercial and recreational fishing and to identify those that may be impacted by the Project. Information obtained from commercial and recreational fishermen through a telephone survey included: areas fished in Long Island Sound, targeted species, gear type, seasons fished, and concerns related to the proposed Project. The outreach program also included a review of available information related to catch.

The CTDEP conducts a yearly study of recreational marine fisheries in Connecticut waters, which includes a Marine Angler Survey. This survey consists of both a Marine Recreational Fishery Statistics Survey (MRFSS) and a Volunteer Angler Survey. The former involves a random telephone survey of households and an intercept survey of anglers at fishing sites; the latter involves the use of data that fishermen record in logbooks, which are submitted to CTDEP (CTDEP 2004).

The MRFSS indicated that an estimated 464,997 marine anglers made 1,537,899 trips in 2003 (CTDEP 2004). The three principal modes of recreational marine fishing included: fishing from shore (40%), fishing from privately owned or rental boats (56%), and

fishing from party and charter boats (4%). Scup was the most frequently creeled fish, followed by bluefish, summer flounder, tautog, and striped bass (*see* Table 8-9). These five species comprised approximately 94% of the total creeled catch.

Table 8-9 Fish Species Caught by Recreational Fishermen in Connecticut in 2003, Their Percentage of the Total Creeled Catch, the Number of Fishing Trips Targeting Each Species, and the Success Rate of These Fishing Trips

	MRFSS	Volunteer Angler Survey	
Species	% of Creeled Catch	No. of Trips	Success Rate (%)
Striped bass	4	2,936	83
Bluefish	18	1,437	84
Summer flounder	6.5	975	92
Tautog	6.5	307	89
Scup	59.4	269	98
Flounder	0.9	117	86

Source: CTDEP 2004.

The Volunteer Angler Survey report revealed that the most common fish targeted (based on number of trips) during recreational fishing included: striped bass, bluefish, summer flounder, tautog, scup, and winter flounder (*see* Table 8-9) (CTDEP 2004).

The MRFSS was developed to provide government agencies, scientists, and the public with reliable estimates of the recreational fishery harvest as far back as 1979. The NOAA Fisheries database was queried for 2003 recreational landings in inland waters of Connecticut and New York, which are defined as "inshore saltwater and brackish water bodies such as bays, estuaries, sounds, etc." (*see* Table 8-10). Resource Report 3, Fish, Vegetation, and Wildlife, provides additional detail regarding recreational fisheries.

According to the MRFSS, recreational landings from New York and Connecticut exceeded 15 million pounds (6.8 million kg) during 2003 (*see* Table 8-10). Bluefish, scup (porgies), striped bass, and summer flounder account for the vast majority of the landings in both states. While the top species harvested in Connecticut according to NOAA Fisheries are consistent with those reported by CTDEP (2004), the total landings are more than twice those reported by CTDEP (2004). One possible reason for this discrepancy is that while CTDEP (2004) relies on only an intercept survey to estimate total landings, NOAA Fisheries relies on that same intercept survey as well as a telephone survey.

Table 8-10 Species and Weight (lbs) of Recreational Fishery Harvest from Connecticut and New York during 2003

Connecticut			New York		
Species	Weight (lbs)[1]	PSE[2]	Species	Weight (lbs)[1]	PSE[2]
Bluefish	1,685,866	12.8	Scup	4,508,447	11.4
Scup	1,528,390	14.3	Summer Flounder	2,027,840	10.7
Striped Bass	1,251,538	14	Bluefish	1,631,444	13.7
Tautog	603,862	19.4	Striped Bass	772,816	17.6
Summer Flounder	410,708	14.1	Winter Flounder	289,766	19.3
Herrings	100,622	30.6	Tautog	232,477	35.8
Winter Flounder	25,803	36.7	Black Sea Bass	56,905	33.1
Dogfish Sharks	12,189	52	Herrings	48,940	49.9
White Perch	11,407	62.8	Weakfish	37,106	57.8
Black Sea Bass	6,515	40	Dogfish Sharks	29,482	73.3
Searobins	5,079	54.6	Searobins	16,614	64.3
Little Tunny/Atlantic Bonito	4,616	100	Puffers	3,728	77.8
Weakfish	3,536	99.7	White Perch	3,214	77.1
Cunner	1,515	46.7	Other Cods/Hakes	2,564	0
Eels	0	0	Triggerfishes/Filefishes	1,693	62.3
Sculpins	0	0	Kingfishes	1,323	100
Freshwater Catfishes	0	0	Cunner	1,177	100
Other Flounders	0	0	Other Flounders	1,131	99.9
Other Fishes	0	0	Eels	0	0
Other Tunas/Mackerels	0	0	Sculpins	0	0
Skates/Rays	0	0	Freshwater Catfishes	0	0
Other Sharks	0	0	Toadfishes	0	0
-- Grand Total --	5,651,646	6.7	Other Fishes	0	0
			Other Tunas/Mackerels	0	0
			Little Tunny/Atlantic Bonito	0	0
			Skates/Rays	0	0
			Other Sharks	0	0
			-- Grand Total --	9,666,666	6.5

Notes:

1 Zero catch indicated catch of <500 lbs.

2 PSE, or proportional standard error, expresses the standard error of an estimate as a percentage of the estimate and is a measure of precision.

8.5 LONG ISLAND SOUND PLANS AND STUDIES

8.5.1 Long Island Sound Comprehensive Conservation and Management Plan

The EPA and the states of New York and Connecticut formed the Long Island Sound Study (LISS) in 1985 in response to concerns regarding the health of the Sound's ecosystem. In 1994 LISS completed a Comprehensive Conservation and Management Plan (LISS 2004) that identified six issues requiring special attention: (1) low dissolved oxygen levels (hypoxia), (2) toxic contamination, (3) pathogen contamination, (4) floatable debris, (5) living resources and habitat, and (6) land use and development. The plan describes ongoing programs and LISS's commitments and recommendations for actions that specifically address the Sound's priority problems. The EPA and the states of New York and Connecticut signed the Long Island Sound Agreement in 2003. The agreement builds on the goals of the 1994 Comprehensive Conservation and Management Plan by adding 30 new goals and targets to restore Long Island Sound. As discussed below, the placement of an FSRU and associated subsea pipeline in the Sound would not conflict with any management objective being implemented or the 30 newly established goals implemented by LISS. Broadwater designed the Project to minimize impacts to the extent practicable and to ensure that the Sound continues to function as a resource of regional significance.

Hypoxia. The discharge of excessive amounts of nitrogen is the primary cause of hypoxia in Long Island Sound. This impact is a primary concern in the western portion of the Sound and in some central portions during the warmer summer months. The concern is highest for waters close to areas with high population densities, where the associated discharges to the Sound (e.g., sewer overflows) often contain elevated levels of contaminants that increase the biological oxygen demand (BOD) in the Sound's waters. Oxygen levels in the Sound also can be affected by runoff from agricultural areas, which may contain excess fertilizers. Broadwater designed the FSRU to minimize wastewater discharge to the Sound, and all discharges will be in accordance with applicable water quality regulations. Waste water generated on the FSRU will be treated prior to being discharged and will not have a BOD greater than 50 milligrams/liter (mg/L). If water quality discharge standards cannot be achieved, Broadwater will ship wastewater to shore for disposal at an approved facility. In addition, based on the results of the spring 2005 field sampling, no significant BOD was identified in the Project area. Any potential elevated BOD levels associated with FSRU discharges would be readily assimilated by the Sound. In addition, since all discharges from the FSRU would occur near the surface, any discharges from the FSRU would not cumulatively impact hypoxic conditions, which are concentrated at or near the bottom in deeper water. Resource Report 2, Water Use and Quality, includes discharge information.

Toxic Contamination. The primary sources of toxic substances entering the Sound are industrial complexes along the major tributaries of the Sound (i.e., the Connecticut, Housatonic, Quinnipiac, and Thames Rivers), sewage treatment facilities, and urban runoff. The location of the FSRU in the central portion of the Sound is unrelated to specific impacts resulting from onshore point-source contamination. Resource Report 2, Water Use and Quality, presents the existing water quality and sediment quality

conditions within the Project area, based on the spring 2005 field surveys. Based on these sampling results, no action levels for any contaminants of concern are exceeded in the Project area.

The proposed FSRU is designed so that all discharges generated are carefully controlled and treated. All discharges from the facility will be in accordance with all applicable water quality regulations. If wastewater discharge standards cannot be achieved, Broadwater will ship wastewater to shore for disposal at an approved facility. Implementation of storm water management controls and spill prevention and countermeasure procedures will minimize the potential release of fuels and other lubricants into the water column. As part of the Project, a site-specific Spill Prevention, Control, and Countermeasures (SPCC) Plan for all Project-related activities will be developed. Accidental discharge of LNG to the Sound has been identified as a potential concern. However, unlike petroleum spills, any LNG discharged to the Sound would float on the surface and completely evaporate, leaving no residue and eliminating potential contamination of marine resources. While there will be air emissions associated with operation of the FSRU, all facility emissions will be in accordance with state and federal regulations and will be subject to review by NYSDEC and EPA. Specific air emissions resulting from construction and operation of the facility are discussed in Resource Report 9, Air Quality.

Pathogen Contamination. Pathogens enter Long Island Sound from untreated or inadequately treated human sewage and wild and domestic animal waste. Vessel sewage discharge has been identified as one of four pathogen sources warranting primary management actions. As part of the 2003 Long Island Sound Agreement, efforts are being made to designate all Sound embayments in New York as vessel no-discharge areas. This and other pathogen-release management actions focus on nearshore areas, where the introduction of pathogens has the greatest potential to adversely affect aquatic life and public health. Based on its offshore location, operation of the FSRU will have no effect on current or planned pathogen management activities. The FSRU design incorporates appropriate treatment of waste prior to discharge, and all discharges will be in accordance with applicable water quality regulations. If water quality discharge standards cannot be achieved, Broadwater will ship wastewater to shore for disposal at an approved facility.

In addition, all vessels berthing at the LNG terminal will be required to comply with the requirements of MARPOL (International Convention on the Prevention of Pollution from Ships). No waste will be discharged from the LNG carriers within Long Island Sound. Additional discussion of discharges from the FSRU are discussed in Resource Report 2, Water Use and Quality.

Floatable Debris. All waste generated at the FSRU will be properly disposed of in accordance with state and federal permit regulations, and no unauthorized release of floatable debris into the Sound will occur. With regard to waste handling, the same practices as developed for offshore oil production facilities will be incorporated into the Broadwater waste management plan.

Living Resources and Habitat. Besides water pollution, destruction and degradation of habitat and over-harvesting from fishing are identified as the primary threats to living resources and habitats in Long Island Sound. Management activities to preserve and enhance living resources focus on nearshore areas and include protection and restoration of tidal wetlands, intertidal sand and mud flats, and submerged aquatic vegetation. Broadwater sited the FSRU and interconnecting pipeline in the central portion of the Sound to avoid impacts on critical inshore resources. While impacts will occur in the central portion of the Sound from installation of the Project, no inshore coastal habitats will be impacted.

Installation of the pipeline and FSRU mooring structure will result in both positive and negative impacts on the existing resources of Long Island Sound. Installation of the mooring structure will affect approximately 13,180 square feet (1,225 m^2) of seafloor. This impacted area is insignificant in terms of the overall substrate available in the Sound. Following installation, the mooring tower will actually increase habitat diversity by providing vertical structure, which is currently absent from the central portion of the Sound. Construction of the Project will result in the short-term displacement of the bottom habitat as the pipeline is installed below the seafloor; however, native communities will be allowed to reestablish following completion of construction. Scheduling installation during the winter months will further reduce impacts by largely avoiding breeding activities and by avoiding the summer season, when a greater number of migratory populations utilize the Sound.

8.5.2 Long Island Sound Coastal Management Plan

The Long Island Sound Coastal Management Plan (CMP) was developed in accordance with the Waterfront Revitalization of Coastal Areas and Inland Waterways Act, Article 42 of the Executive Law, and the New York State Coastal Management Program. The Long Island Sound CMP views the coast from four perspectives: the developed coast, the natural coast, the public coast, and the working coast. Thirteen policies were developed to guide development along the coast. A coastal zone consistency determination is being developed for the Project and will be submitted to NYSDOS.

The Long Island Sound CMP, which addresses the upland watershed, harbors, and nearshore waters of the Sound, is designed to complement the Long Island Sound Study Comprehensive Conservation and Management Plan, which focuses on water quality in the deep waters of the Sound. The CMP also is designed to integrate the capabilities of state and local government into an enforceable program for the Sound.

The Long Island Sound CMP refines the existing New York State Coastal Management Program and incorporates the existing array of local programs and laws governing activities in the coastal areas. The CMP replaces the state's Coastal Management Program for the Sound's shorelines in Westchester County, New York City to the Throgs Neck Bridge, Nassau County, and Suffolk County.

In addition to the CMP, eight communities along Long Island Sound have approved Local Water Revitalization Programs (LWRPs) that further expand upon the state of Long Island Sound coastal policies, with specific emphasis on town resources.

8.5.3 Long Island North Shore Heritage Area Management Plan

The Long Island North Shore Heritage Area Management Plan was developed to provide the communities in the north shore region of Long Island with the tools needed to preserve and celebrate the cultural, historic, and natural heritage of the north shore. The plan, which addresses the New York State Heritage Areas System goals of cultural resource management for regional economic revitalization, highlights: (1) identification and preservation of natural and historic places; (2) education about local, regional, and natural history; (3) recreational use of special places; and (4) economic development with public and private investment.

The Long Island North Shore Heritage Area is generally described as the north shore from the Long Island Expressway or State Route 25 (whichever is further south) to the Connecticut line in Nassau and Suffolk counties.

The Long Island North Shore Heritage Area Management Plan has the three-part mission of preservation, revitalization and economic expansion, and sustainable heritage development. The goals and objectives of the plan seek to identify potential areas of conflict and mitigate them while providing a framework for enhancing the similarities and the differences of the people of the North Shore and their communities. The policies and actions are the primary implementation tools of the plan and include preservation, sustainable heritage development, and economic revitalization for the Heritage Area. The proposed FSRU and subsea pipeline will not adversely impact the stated goals of the North Shore Heritage Area Management Plan.

The Management Plan calls for strategic planning to protect water (coastlines, beach views, and water access), sites and structures (landmarks, estates, and historic sites), sites of historic maritime activity, and natural areas. The Project was sited to avoid impacts on wrecks and other cultural resources to the maximum extent practicable. The VRA for the Project evaluates the Project's impact on historic sites or structures, sites of historic maritime activity, and onshore natural areas. The Project was also evaluated to determine any potential impacts on coastline resources, including those associated with beach views. While the FSRU will be visible from the shore on clear days (including beach areas), the facility will be similar in appearance to ships that already use the Sound.

The Project has the potential to result in minor, short-term negative impacts on marine natural resources during construction, but also has the potential to result in long-term positive impacts during operation by providing a reliable source of clean-burning natural gas, which may contribute to regional air quality improvements. Construction impacts are related to minor and short-term disturbance to marine habitat and water quality. Therefore, the Project is not expected to adversely affect preservation of the cultural, historic, and natural resources of the Sound and thus is consistent with the North Shore Heritage Area Management Plan with respect to these elements.

Economic revitalization is a key component of the Management Plan and calls for creative land use to protect structures and districts, guidance for new construction, protection and enhancement of existing features, and focused heritage development with increased economic viability. The main focus of these activities are on the built environment, including downtown areas, maritime communities, and commercial centers; natural environmental features, including access points and open space; and development of focal point or attractions for interpretation and celebration of the Heritage Area. The Project was sited in the middle of the Sound to avoid conflicts with these built environments, especially those areas designated as important historic and cultural resource areas.

8.6 PUBLIC LAND, RECREATION, AND OTHER SPECIAL LAND USE DESIGNATIONS

8.6.1 Public or Conservation Land

Public land, recreation, and other special land use designations were identified by reviewing maps of the Project area, through consultations with local officials, and field reconnaissance. There are no designated marine reserves or sanctuaries within Long Island Sound. Given its location offshore in Long Island Sound, the proposed Project will not cross any Native American reservations, national forests, national natural landmarks, nationally designated wild and scenic rivers, wildlife management areas, registered national landmarks, or state forests. There are no public or conservation lands located within 9 miles (14.5 km) of the proposed Broadwater FSRU site. The nearest lands of these types are located approximately 9 miles (14.5 km) to the south in Wildwood State Park in Wading River, New York. Wildwood State Park comprises 600 acres of undeveloped forestland situated on a bluff overlooking Long Island Sound. The park is open year-round and offers amenities such as a beach, camping, hiking, and fishing. Several small parks are located on the Connecticut shoreline; however, these areas are more than 10 miles (16 km) from the proposed Project area.

8.6.2 Natural Areas, Recreation Areas, and Scenic Areas

Although Long Island Sound is widely used as a regional recreational resource, no designated natural recreation areas are located within 9 miles (14.5 km) of the proposed Broadwater FSRU location or subsea pipeline. Scenic areas and registered natural landmarks are discussed in more detail in Section 8.7. Recreational use of the Sound includes activities such as boating, fishing, and swimming. However, most of this activity occurs in the coastal and nearshore areas, away from the proposed Project location. The designated recreational areas nearest to the proposed FSRU and subsea pipeline are located onshore, approximately 9 miles (14.5 km) from the FSRU site. No designated or proposed National or State Wild and Scenic Rivers will be affected by construction of the proposed FSRU or subsea pipeline.

8.7 VISUAL RESOURCES

Home to many types of users, both industrial/commercial and recreational, the waters of Long Island Sound are an integral part of the overall character and setting of the coastal

region of New York and Connecticut. Therefore, Broadwater conducted a thorough and detailed VRA to address potential visual impacts associated with the proposed Project. The analysis was conducted in accordance with NYSDEC's Program Policy *Assessing and Mitigating Visual Impacts* (NYSDEC 2000). The following provides a summary of potential Project-related visual impacts. The complete VRA is included as Appendix D.

8.7.1 Visual Assessment

Based on a comprehensive evaluation of project alternatives (*see* Resource Report 10, Alternatives), the Project was sited near the center of the Sound at its widest point, in part, to maximize the distance from any coastal vantage point and minimize potential visual impact on coastal resources. The proposed FSRU location is approximately 9 miles off the Long Island coast and 10 miles off the coast of Connecticut.

There is no location within the Sound where the project would be substantially farther from the nearest coastal observer. While the color(s) of the FSRU/YMS structures has not been determined, there are options available. For example, shades of gray can be used to minimize contrast between the LNG terminal and the washed-out blue-gray colors of the background and foreground waters of the Sound.

The outer limits of the evaluated study area extend out 25 miles from the proposed LNG terminal. This study radius was selected based on the following factors:

- **Curvature of the Earth.** For an observer standing approximately 40 feet above sea level at a distance of 25 miles from the facility, all portions of the FSRU below the Helideck (148 feet [45 m] above waterline) will be below the visible horizon. Similarly, for an observer standing at beach elevation, the helideck would disappear below the horizon at a distance of approximately 20 miles.

- **Meteorological Visibility.** The proposed LNG terminal will be completely obscured from all coastal vantage points by haze or fog at least 24% of the time based on local meteorological conditions.

- **Sheer Distance.** A broadside view of the FSRU at a distance of 25 miles would measure only 0.6 degrees horizontally on the horizon and 0.08 degrees vertically. It is unlikely that an object of such limited visibility would be considered a significant point of interest to the typical observer.

The vast majority of views of the proposed LNG terminal will be limited to immediate shoreline locations. In most locations, the visibility of the Project is quickly screened from inland vantage points by dense coastal vegetation, topography, and structures. A comprehensive set of viewshed maps is provided in the VRA.

The north shore of Long Island includes nearly 55 miles of coastline within the 25-mile study radius. Of this, the proposed LNG terminal will be visible from approximately 44 miles of coastline (80%). The Connecticut side of the Sound within the 25-mile study

radius includes nearly 92 miles of coastline. Of this, the proposed LNG terminal will be visible from approximately 46 miles (50%) of the shoreline. No coastal area with an approved New York State LWRP falls within the affected viewshed area.

Broadwater conducted a thorough inventory of all aesthetic resources meeting NYSDEC's definition of national and statewide significance, as well as those meeting a more conservative definition of resources of local interest within the 25-mile study radius. Two hundred and twenty-eight locations meeting theses definitions were identified within the affected viewshed area. The vast majority of resources of statewide significance or local interest found along the Long Island and Connecticut coastlines are seasonal day-use public beaches and waterfront parks.

The Connecticut and Long Island coastal areas include numerous private residential properties (both permanent and second homes) that are clearly oriented to take advantage of scenic views of the Sound. These properties are found at beach level and on surrounding hillsides with unimpeded views towards the Sound. Because of these views, these homes are almost always of very high real estate value and are often cherished places for families who live or vacation there. The coastal area is also a popular seasonal tourist destination. Visitors to waterfront hotels and bed-and-breakfast type establishments open to the general public choose to vacation along the Sound to enjoy the natural and cultural ambiance of the coastal landscape.

Visual impacts are subjective and will be experienced on an individual basis. Affected viewers will most commonly be local residents enjoying views of the Sound from their homes and neighborhoods, as well as visitors enjoying passive or active recreational pursuits from coastal or on-water locations.

The proposed LNG terminal will be the largest moored object on the Sound. However, with the nearest coastal vantage point being approximately 9 miles distant, shoreline viewers will see the proposed Project within the far background distance zone. At this distance, elements lose detail and become less distinct. Typically, atmospheric perspective (hazing) reduces colors to blue-grays, while surface characteristics (lines and textures) are lost. On clear days, the FSRU/YMS and LNG carrier may be a point of visual interest for observers at the closest vantage points along both the New York and Connecticut coastlines. However, the proposed LNG terminal will decrease in visibility from distant receptors up and down the coast with increased distance over the horizon and the compounding effect of atmospheric perspective.

When visible, the proposed facility will generally appear as a small, two-dimensional rectilinear form on the horizon from distant coastal vantage points. Although a relatively small element within the context of the Sound, the geometric form of the LNG terminal contrasts with the expansive planar form of the Sound and sky. While the outline of the Project will break the visible horizon, from distant coastal vantage points the Project will appear quite low and, as distance increases, be increasingly difficult to distinguish from the horizon.

Photo-simulations taken from various locations throughout the coastal regions of Long Island and Connecticut are included as Appendix A in the VRA. The VRA is attached to this Resource Report as Appendix D.

8.7.2 Conclusion

The proposed LNG terminal was sited near the center of the Sound at its widest point, in part, to maximize the distance from any coastal vantage point and minimize potential visual impacts on coastal resources. The LNG terminal will be approximately 9 miles from the nearest coastal vantage point, and there is no location within the Sound where the project would be substantially farther from the nearest coastal observer. While the color(s) of the FSRU/YMS structures has not been determined, there are options available. For example, shades of gray can be used to minimize contrast between the LNG terminal and the washed-out, blue-gray colors of the background and foreground waters of the Sound. These factors combine to minimize visual distinction and perceived importance of the Project within the context of the regional landscape/waterscape. Importantly, any residual impacts will not be permanent. As required by NYSDEC's Visual Policy, at the end of its useful life the FSRU/YMS will be decommissioned by complete removal, restoring the Sound to its pre-Project visual condition.

NYSDEC's Visual Policy states:

> *"Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Significant aesthetic impacts are those that may cause a diminishment of the public enjoyment and appreciation of an inventoried resource, or one that impairs the character or quality of such a place. Proposed large facilities by themselves should not be a trigger for a declaration of significance. Instead, a project by virtue of its siting in visual proximity to an inventoried resource may lead staff to conclude that there may be a significant impact."*

Based on this definition, it is reasonable to conclude that visibility of the proposed LNG terminal, albeit a large facility, does not result in a detrimental effect on the perceived beauty of any place or structure, nor will the Project cause a diminishment of public enjoyment and appreciation of an inventoried resource or impair the character or quality of such a place.

8.8 COASTAL ZONE MANAGEMENT

In New York State, the New York State Department of State (NYSDOS) is responsible for coastal zone consistency review, having been delegated review authority by the U.S. Department of Commerce. Broadwater consulted with NYSDOS to determine the appropriate coastal management policies for the Project to consider with respect to coastal zone consistency. Thirteen coastal zone policies have been adopted for the Long Island Sound region, and NYSDOS has directed Broadwater to review the Project with respect to these policies, which supersede the state's more general 44 coastal policies. Broadwater is preparing a complete coastal zone consistency evaluation.

Beginning in the earliest stages of the Project, Broadwater carefully reviewed and evaluated New York State's 13 coastal policies and corresponding sub-policies for Long Island Sound, and consideration of those policies has been factored into Broadwater's project design. As mentioned previously, throughout 2005 Broadwater has met with the NYSDOS to discuss project development, provide updated technical information, and seek input on various design elements of the Project. A comprehensive Coastal Zone Assessment that will confirm consistency with each of the 13 policies and corresponding sub-policies is being prepared and will be submitted to the NYSDOS following Broadwater's application to FERC.

8.9 APPLICATIONS FOR RIGHTS-OF-WAY AND OTHER LAND USE

Broadwater intends to apply to the New York State Office of General Services (NYSOGS) for a lease, easement, permit, or combination thereof for underwater state-owned land pursuant to the New York State Public Lands Law. The process will involve the completion of NYSOGS form applications, submitting such applications and supporting documentation to NYSOGS for review, and service of a Notice of Application. A Notice of Application is expected to be provided to each city, town, or village in which the underwater, state-owned land is situated. New York State currently charges $16.64 per linear foot for 30-foot-wide easements for underwater gas pipelines. Broadwater will be required to pay a one-time fee for an easement. Broadwater will coordinate with the New York State Office of General Services, with the final payment amount based on final design.

Because the height of the emergency flare mast to be located on the proposed FSRU exceeds 200 feet above the waterline, Broadwater is required to submit Form 7460-1 (*Notice of Proposed Construction or Alteration*) to the United States Department of Transportation, Federal Aviation Administration (FAA), for review. The form was submitted, and the FAA has assigned Broadwater a project case number (BROAD – 000029200-05) and will initiate its review of the project (*see* Appendix E). The FAA will review the Broadwater project for any potential impacts on commercial aviation facilities in the region from the proposed facilities on the FSRU. The closest major airport to the proposed Broadwater facility location is the Tweed New Haven Airport, which is located 11.5 miles (18.5 km) northwest of the proposed FSRU location.

8.10 FACILITY ABANDONMENT

There are no existing facilities that are proposed for abandonment as a part of this project.

8.11 AGENCY AND LANDOWNER CONSULTATION

Required permits and approvals; agencies with regulatory authority over the Broadwater Terminal; and the status of permitting with these agencies are presented in Resource Report 1 (General Project Description), Tables 1-5 and 1-6. All required permits, approvals, and reviews for the Project will be obtained. There are no private landowners with ownership interests in lands impacted by the Project. Broadwater is in consultation

with the State of New York with respect to the State's interest in the subsea floor of Long Island Sound located within New York State boundaries.

8.12 REFERENCES

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APPENDIX A

LNG CARRIER ROUTE ANALYSIS

Sensitive Security Information has been removed

from the Public Volume and is contained in the Sensitive Security Information Volume.

APPENDIX B

BOAT TRAFFIC SURVEY

BROADWATER

BOAT TRAFFIC SURVEY

FOR A

PROJECT TO CONSTRUCT AND OPERATE A

LIQUEFIED NATURAL GAS RECEIVING TERMINAL

IN

LONG ISLAND SOUND

LONG ISLAND, NEW YORK

UNITED STATES OF AMERICA

JANUARY 2006

Public

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1 INTRODUCTION

Broadwater Energy, a joint venture between TCPL USA LNG, Inc., and Shell Broadwater Holdings LLC, is filing an application with the Federal Energy Regulatory Commission (FERC) seeking all of the necessary authorizations pursuant to the Natural Gas Act to construct and operate a marine liquefied natural gas (LNG) terminal and subsea pipeline for the importation, storage, regasification, and transportation of natural gas. The Broadwater LNG Project (the Project) will increase the availability of natural gas to the New York and Connecticut markets through an interconnection with the Iroquois Gas Transmission System (IGTS). The FERC application for the Project requires the submittal of 13 Resource Reports, with each report evaluating Project effects on a particular aspect of the environment.

This Boat Traffic Survey was developed as a supporting study to Resource Report 8 (Land Use, Recreation, and Aesthetics). In this survey, Broadwater has undertaken an assessment of the potential impact of the FSRU and subsequent pipeline construction on commercial and recreational boating activities in Long Island Sound. In an effort to supplement and expand on literature research and interviews with local resources, the boat survey was conducted to observe commercial and recreational traffic patterns in the vicinity of the proposed Project.

The objective of the evaluation was to observe and quantify boat use in the area of the proposed Project during holiday weekends and other high-use days during the summer in order to determine the maximum boat traffic near the proposed floating storage and regasification unit (FSRU) and pipeline. High-use days included days where sailing regattas and excellent weather coincided, which often overlapped with holiday weekends. The intent of the surveys was to identify trends in boating traffic within the Project area, not to provide definitive conclusions.

The proposed Broadwater LNG terminal will be located in Long Island Sound (the Sound), approximately 9 miles (14.5 kilometers [km]) from the shore of Long Island in New York State waters, as shown on Figure 8-1. The LNG terminal facilitates the sea-to-land transfer of natural gas. It will be designed to receive, store, and regasify LNG at an average throughput of 1.0 billion cubic feet per day (bcf/d) and will be capable of delivering a peak throughput of 1.25 bcf/d. The Project will deliver the regasified LNG to the existing interstate natural gas pipeline system via a subsea interconnection to the IGTS pipeline.

The proposed LNG terminal will consist of an FSRU that is approximately 1,215 feet (370 meters [m]) in length, 200 feet (60 m) in width, and rising approximately 80 feet (25 m) above the water line to the trunk deck. The FSRU's draft is approximately 40 feet (12 m). The FSRU will be designed to accommodate net storage of approximately 8 billion cubic feet (bcf) (350,000 cubic meters [m^3]) of LNG, with base vaporization capabilities of 1.0 bcf/d using a closed-loop shell and tube vaporization (STV) system. The LNG will be delivered to the FSRU in LNG carriers with cargo capacities ranging from 125,000 m^3

up to a potential future size of 250,000 m^3 at the frequency of two to three carriers per week.

The FSRU will be connected to the send-out pipeline, which rises from the seabed and is supported by a stationary tower structure. In addition to supporting the pipeline, the stationary tower also serves the purpose of securing the FSRU in such a manner to allow it to orient in response to prevailing wind, wave, and current conditions (i.e., weathervane) around the tower. The tower, which is secured to the seabed by four legs, will house the yoke mooring system (YMS) allowing the FSRU to weathervane around the tower. The total area under the tower structure, which is of open design, will be approximately 13,180 square feet (1,225 square meters [m^2]).

A 30-inch-diameter natural gas pipeline will deliver the vaporized natural gas to the existing IGTS pipeline. It will be installed beneath the seafloor from the stationary tower structure to an interconnection location at the existing 24-inch-diameter subsea section of the IGTS pipeline, approximately 22 miles (35 km) west of the proposed FSRU site. To stabilize and protect the operating components, sections of the pipeline will be covered with engineered back-fill material or spoil removed during the lowering operation. Figure 8-1 presents the proposed pipeline route.

2 EXISTING USE OF LONG ISLAND SOUND

The Long Island Sound Study[1] identifies Long Island Sound, with its 8 million inhabitants within the Sound watershed - and millions more visiting each year, as the dominant recreational and economic resource in the region. Research commissioned by the Long Island Sound Study estimated that about $5 billion is generated annually in the regional economy from boating, commercial and sport fishing, swimming, and beachgoing.

Navigation-dependent activities are very important to the economies of New York and Connecticut. Official vessel traffic routes do not exist within Long Island Sound. In the absence of a routing scheme in the Sound, federal navigational aides and the use of standard marine practices have led to the development of established traffic patterns and generalized shipping routes in the Sound. The main shipping route for accessing Connecticut deepwater ports runs generally down the center of the Sound on a straight course from deepwater areas in the eastern Sound to the deepwater pass through Stratford Shoal. A second primary shipping route exists on a northeast to southwest alignment toward the Northport Harbor area in New York. From both of the two primary east-west shipping routes, traffic branches to enter the existing ports throughout the Sound. Due to the greater port development in Connecticut and those ports' ability to accommodate deepwater draft vessels, significantly more commercial traffic and identified shipping routes branch off toward the Connecticut shoreline. Commercial traffic primarily follows the east-west axis of the Sound, with divergence from this course only to access specific

[1] (*Comprehensive Conservation and Management Plan for Long Island Sound*, 1994. Available at: http://www.longislandsoundstudy.net/mgmtplan.htm)

ports on either the Long Island or Connecticut coastlines. As discussed in Resource Report 10, Alternatives, Broadwater proposed an FSRU location that falls between the two primary east-west shipping routes to minimize potential impacts during operation of the facility.

Due to the depths found throughout the central portion of Long Island Sound (greater than 66 feet [20 m]), maintenance of navigation channels is not required, with the exception of buoy deployment to identify shoaling areas. Maintained (i.e., dredged) navigation channels are restricted to nearshore areas and within the rivers and harbors along the Sound. The locations of ports around the Sound and the presence of Stratford Shoal, which is centrally located in the Sound, largely dictate the specific routes that shipping follows in the Sound.

Swimming, boating, and fishing are the three major water quality-dependent activities in Long Island Sound. Specifically, recreational and commercial uses of the Sound include:

- **Commercial/Recreational Fishing.** The commercial fishing industry provides many jobs and contributes millions of dollars to the economies of both New York and Connecticut. Commercial fishing occurs throughout the Sound. Nearshore areas, particularly in Connecticut, are used primarily by shell fishermen, while the deeper waters of the Sound are used by lobsterman, who are dependent on trapping, and trawlers. Historic user agreements among the Long Island Sound fisherman have largely defined specific fishing territories. In addition, charter boat companies and private individuals use Long Island Sound as a recreational fishing area. Commercial and recreational fishing activities are discussed in detail in Resource Report 8, Land Use, Recreation, and Aesthetics.

- **Regattas.** Boating is a popular pastime on Long Island Sound, primarily from late spring to early fall, when the weather is more amenable. Whereas motorboating tends to be an individualistic activity, competitive and recreational racing (regattas) have become the norm for sailboating. The following regattas have been identified as occurring on an annual basis on Long Island Sound (with 2005 dates provided). In addition to these larger Soundwide regattas, many additional regattas and races take place on a more localized basis. Local sailing events typically are held in proximity to the clubs sponsoring the events and are limited to areas nearer shore.

  - Block Island Race Week (June 19-25, 2005). This regatta consists of four fleets and 29 races held off Rhode Island's Block Island. The race has no specific course but is raced on 2- to 3-mile courses in Block Island Sound.
  - Stratford Shoal Race (July 2, 2005). This regatta originates at the Riverside Yacht Club in Riverside, Connecticut. In 2005, the race had two courses, with the starting line for each located off Flat Neck Point, southeast of Greenwich, Connecticut. The first course was the Stratford

Shoal Light Course, which runs for 45 miles. The second course was the Cable & Anchor Course, which runs for 27 miles.

- Around Long Island Regatta (July 28, 2005). This regatta originates near Brooklyn, New York, heads along the southern Long Island shore past Jones Beach and Shinnecock Inlet, up the eastern end of Long Island to Orient Point, and finishes near Glen Cove.
- Vineyard Race (Labor Day weekend). This 238-mile course runs from Shippan Point, through the central portion of the Sound, through the Race, past Block Island, and on to the light tower at the entrance to Buzzard's Bay, returning back from Block Island en route to the finish in Stamford Harbor, in Stamford, Connecticut.

- **Ferry Routes.** Several year-round ferry services operate in Long Island Sound.

- **Sightseeing Tours.** A number of touring companies offer sightseeing tours throughout Long Island Sound. Tours are given mainly in nearshore areas and do not generally traverse the central portion of the Sound.

3 SUMMER 2005 BOAT SURVEYS

To assess and quantify boat use in the area of the proposed project, Ecology and Environment, Inc., (E & E) conducted on-water surveys during anticipated peak usage days on Long Island Sound to assess typical volume and types of boat traffic that frequent the Project area. Surveys were conducted on nine optimal days during the summer of 2005 to assess typical boating usage. The dates selected included days that were anticipated to have the highest volume of recreational traffic and during which weather conditions were ideal for recreational boating. These dates include Memorial Day weekend, Father's Day weekend, the July 4th weekend, the weekend of July 29-30, and Labor Day weekend. The survey on the Sunday of Father's Day weekend was cut short due to severe weather; therefore, it was not treated as a survey day and was excluded from this report. All surveys originated in Port Jefferson, New York, with a typical departure time of 9:30 A.M., and concluded in the evening back at Port Jefferson with surveys completed by approximately 6:00 P.M. The data collected during these surveys provided the basis for determining whether the Project could be expected to have significant adverse affects on recreational and commercial boat uses on the Sound. A detailed description of the survey methodology is presented below.

3.1 Methodology

To determine potential recreational and commercial impacts of the proposed Project on boating, it was necessary to develop a sound methodology to measure boating traffic on Long Island Sound. High-use days and holidays were selected to measure the greatest level of traffic on the Sound; therefore, seven of the nine days were spent surveying boating activity on holiday weekends. The additional two days were spent surveying boating activity during the week in an effort to measure any marked difference between recreational and commercial boating. In addition, the surveys documented conditions

throughout the Project area in both the morning and afternoon hours. The boating surveys alternated between two types of survey days: starting the survey at the Iroquois Gas Transmission System (IGTS) IGTS tie-in site, traveling the length of the proposed pipeline, and surveying the remainder of the day at the FSRU site; or starting the survey at the FSRU site and documenting boat traffic there for several hours and then traveling the proposed pipeline route to either the IGTS tie-in site or Stratford Shoals, weather permitting. All survey's began and ended in Port Jefferson. Travel to the sites from Port Jefferson took approximately one to two hours, depending on whether the survey originated at the tie-in or the FSRU.

The on-water surveys comprised a total of 72 hours, with 39 hours spent at the proposed location of the FSRU, 15 hours spent surveying along the proposed pipeline route, and the remaining 18 hours spent traveling to the Project area from Port Jefferson.

Survey methodology entailed recording the following parameters for boat traffic within the Project area:

- Time and date of sighting,
- Boat size,
- Boat type,
- Distance from the observation boat,
- Orientation to the observation boat, and
- Direction that the vessel was traveling.

Boat size (length) was classified as follows:

- 1 = 0-15 feet,
- 2 = 15-30 feet,
- 3 = 30-45 feet,
- 4 = 45-60 feet,
- 5 = 60-75 feet,
- 6 = 75-90 feet, and
- 7 = >90 feet.

Boat type was classified as one of the following:

- R = Recreational,
- C = Commercial,
- B = Barge and Tugboat,
- F = Fishing,
- L = Lobster,
- P = Power, and
- S = Sail.

*Example: A recording marked **CL Class 3** translates into a Commercial Lobster Boat between 30 to 45 feet in length.*

The distance between the observation boat and the observed vessel was estimated by the survey team, with the boat captain having 45 years experience working on the water. Although the majority of survey data was recorded when boats were closer to the observation boat (within 2.5 miles), other vessels (e.g., large recreational boats, barges, etc.) were recorded at distances of up to 7 miles. Recordings were made when the boats passed at the closest distance to the observation boat, and a photo log was kept of each boat within a reasonable distance allowing adequate resolution with a digital camera.

3.2 Findings

The surveys indicated that, in general, weather and water conditions significantly affected the size, type, and number of watercraft that were on the Sound. Calmer days with less wind resulted in more recreational powerboats of varying size, while days with greater wind provided ideal conditions for sailboats. The majority of boats observed during the surveys were recreational power and sailboats with significantly more recreational boat traffic later in the summer season coinciding with warmer air and water temperatures. The greatest number of vessels was recorded over the July 4th weekend. Alternatively, the fewest number of boats were recorded on Tuesday, May 31, 2005, following Memorial Day weekend. This supports the hypothesis that fewer recreational boats are observed during the week compared to weekends.

Over the course of the nine boat surveys, 329 boats were recorded within 2.5 miles of the observation boat: recreational powerboats comprised 49.5% of the traffic (163/329); sailboats comprised 32.9% of the traffic (108/329); lobster boats comprised 8.2% of the traffic (27/329); and all other commercial boats, including commercial barges, tugboats, ferries, and commercial fishing boats comprised 9.4% of the traffic (31/329). The frequency of the ferry run from Port Jefferson to Bridgeport was so often that it was recorded only once and was not included in Figure 1. Therefore, Figure 1 represents 328 boats instead of 329 (*see* Figure 1).

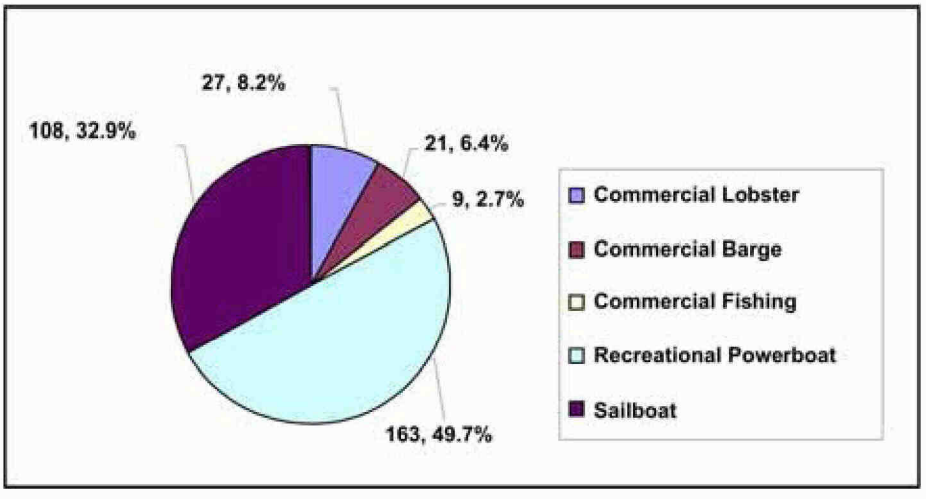


Figure 1 Percentage of Boat Types at all Survey Points

The most frequently viewed boat size, making up 56.2% of all boats observed, was Class 3 (30 to 45 feet), with 44.3% of the Class 3 boats being recreational sailboats. The second most frequently viewed boat size was Class 2 (15 to 30 feet), representing 31.3% of all boats observed. Of the Class 2 boats recorded, 72.8% were recreational powerboats, whereas only 19.4% of the Class 2 boats were sailboats (*see* Figure 2).

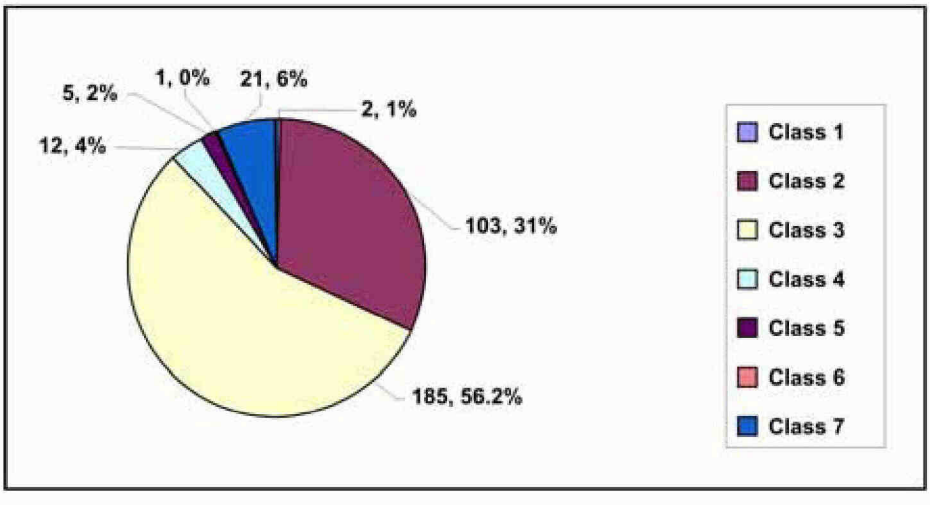


Figure 2 Percentage of Boat Classes at all Survey Points

The commercial boats observed represented a full range of sizes and types, including commercial lobster boats, fishing charters, tugboats and barges, as well as the Connecticut-Long Island ferry between Port Jefferson and Bridgeport. Fifty-eight commercial boats were observed during the nine surveys, representing 17.6% of all boats recorded. The majority of commercial boats were lobster boats (46.5%) either tending their lobster traps or steaming from buoy to buoy. The remaining commercial boats were primarily large class 7 barges and tugboats traveling east-west.

High densities of boats were consistently recorded in proximity to Stratford Shoals. A large number of fishing charters and private recreational fishing boats trolled the Stratford Shoals vicinity, which can be attributed to the change in benthic topography and shallower water, which provides excellent habitat for fisheries. Conversely, very few recreational or commercial fishing boats were observed outside the direct vicinity of Stratford Shoals. Commercial lobster boats were recorded at all points throughout the Project area, and evidence of lobster fishing (i.e., buoys marking lobster pots) was also evident throughout the Project area.

A secondary analysis was performed on the 181 boats recorded in the vicinity of the proposed FSRU location during the nine surveys. The results of this secondary analysis were similar to those of the overall survey, with the majority of boats being recreational powerboats (51.9%), followed by sailboats, particularly sailboats ranging from 30 to 45 feet (Class 3). Of the 65 sailboats recorded in the vicinity of the proposed FSRU site, 75% were Class 3 (30 to 45 feet), whereas only 51% of recreational powerboats were Class 3. Figure 3 presents the type, size class, and number of boats observed in the vicinity of the proposed FSRU location.

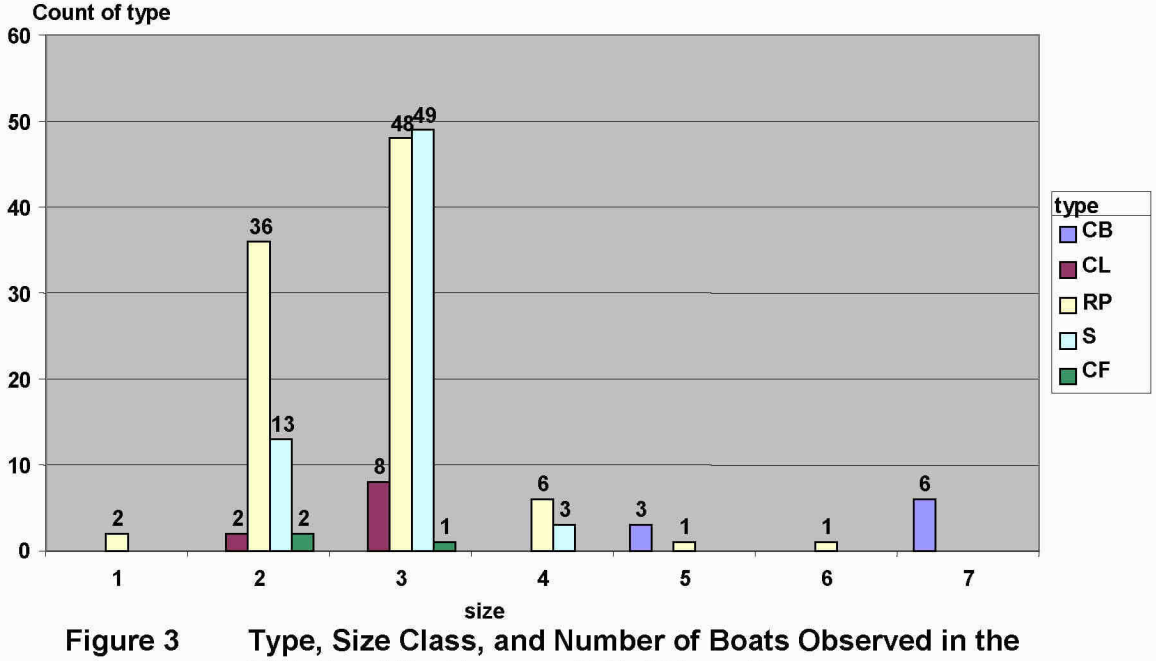


Figure 3 Type, Size Class, and Number of Boats Observed in the Vicinity of the Proposed FSRU Location

Additional analysis determined that 44.8% of the boats observed in the vicinity of the proposed FSRU location were within 0.6 mile of the FSRU location (*see* Figure 4). This is relevant in that it is expected that the U.S. Coast Guard will implement some type of exclusion/restricted zone within which non-project-related vessel traffic will not be allowed. Given that 39 hours were spent surveying on station at the proposed FSRU location, this equates to an average of approximately 2.1 boats transiting within 0.6 mile

of the proposed FSRU per survey hour. This is an insignificant number of boats given the number of recreational and commercial vessels that use Long Island Sound.

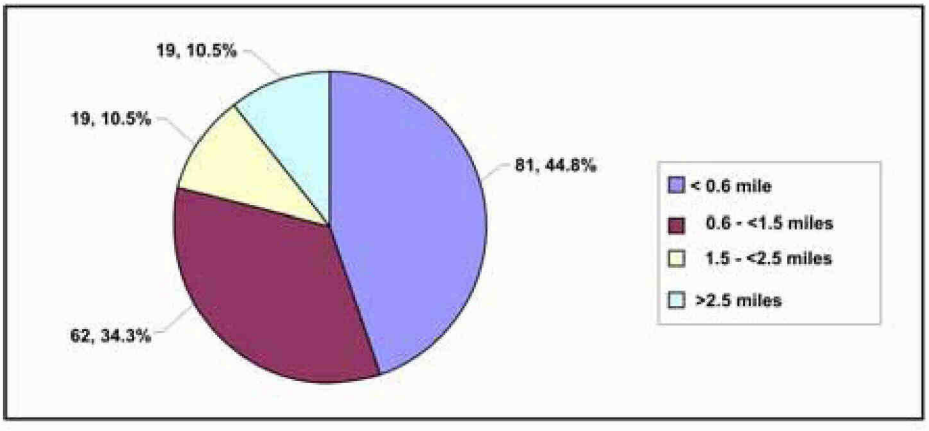


Figure 4 Distance of Boats From the FSRU

The surveys focused primarily on identifying boats that came within 2.5 miles of the observation boat (i.e., within approximately 2.5 miles of the proposed locations of project components). This distance was determined based on technical considerations and data accuracy requirements. From a technical standpoint, in terms of risk to public safety and property, hazards from credible spill scenarios (accidental or intentional) would not extend beyond this distance (*see* Resource Report 11, Safety and Reliability). From a data reliability standpoint, at a distance greater than 2.5 miles the accuracy of surveying dropped markedly due to the distance between the boats. Therefore, primarily large commercial boats were recorded at great distances, and the smaller recreational craft were not.

Only two commercial lobster boats were recorded within 0.6 mile of the proposed FSRU location during the nine survey days, though there was evidence of lobster fishing equipment nearer the proposed FSRU location. Because lobster harvesting is largely driven by the population dynamics of the species, with no real consideration for weather conditions, this survey cannot be considered definitive in assessing commercial lobstering activities in the area. In fact, as discussed in Resource Report 8 (Land Use, Recreation, and Aesthetics), it is recognized that the entire Project area is heavily fished for lobster.

Only three large commercial barges were observed within 1 mile of the proposed FSRU location during the nine survey days. Each barge was traveling on an east-west transit of the Sound. As within the commercial fishing fleet, the commercial shipping industry is less influenced by weather or time of day. Therefore, these surveys cannot be considered definitive in assessing aspects of current shipping activities. However, the few observations that were made of these ships support the contention that they use established shipping lanes and indicate that large commercial vessels, which were observed traveling primarily east-west, travel outside of the impact zone and thus will not be impacted by the FSRU.

On only one occasion during the course of the surveys was a sailing regatta observed to utilize the Sound in proximity to the proposed FSRU location. On June 18, 2005, a regatta consisting of approximately 11 Class 3 boats passed within 25 to 200 yards of the proposed FSRU location, sailing southwest towards Mount Sinai and Port Jefferson. The regatta took a half hour to pass the FSRU site. Based on its orientation, the regatta likely was a local race that originated on Long Island, sailing to Connecticut and back in one day.

While no other regattas were observed within the immediate vicinity of the proposed FSRU location, it is reasonable to expect that regattas would use the central portion of the Sound, and specifically the Project area, based on existing weather and wind conditions. However, as observed throughout the summer, there is ample room for the regattas to make minor adjustments to courses, if necessary, to avoid the proposed FSRU location.

3.3 Discussion and Conclusions

The boat traffic surveys conducted during the summer of 2005 provided insights into the levels of boating activity in the vicinity of the Project area. Data collected during the surveys indicate that boat traffic is greatest near the Stratford Shoals section of the proposed pipeline route, where commercial fishing, ferry service, and general recreational use is highest due to the area's shallower water, relatively short distance from shore, and proximity to larger populations. Therefore, construction of the Project has the potential to impact areas used for commercial and recreational purposes. However, construction is scheduled to occur during late fall and winter, which will minimize impacts on commercial and recreational uses. Use of the Sound in the late fall and winter would be expected to be restricted primarily to commercial uses, although some recreational use may continue. In addition, the portions of the Sound excluded from recreational and commercial uses during construction would be limited to the area of active installation. Because of the time required to install the FSRU, construction impacts would be of longer duration, and, as discussed below, the FSRU would have permanent impacts once the facility becomes operational.

Operation of the subsea pipeline would have no long-term impact on boating in the Sound. The location of the pipeline will be depicted on current NOAA navigation charts to inform boaters of its presence, and the pipeline will be simply an addition to existing utilities that are presently located in the Sound.

Operation of the FSRU will result in some impact on boating within the Sound. Broadwater expects that the U.S. Coast Guard will designate a safety and security zone around the facility, within which non-project-related boat traffic will potentially be excluded. For the few lobster fisherman that actively fish in proximity to the proposed FSRU location, this would represent a potentially significant impact due to loss of income.

Impacts on recreational boating will not be significant. The boat traffic surveys conducted during the summer of 2005 demonstrated that recreational boating activity in

proximity to the proposed FSRU location is minimal, with boats only occasionally transiting within 0.6 mile of the proposed FSRU location. Based on the width of Long Island Sound in the Project area and the relatively low density of recreational vessels using the area, boat traffic can easily route around the USCG-designated safety and security zone following construction. Sailboats participating in east-west oriented sailing regatta's may rely on currents and winds in the Project area.

No chartered recreational fishing boat was noted within the proposed FSRU area at any time during the surveys. This is not unexpected, due to the lack of structure and topography on the seafloor near the proposed FSRU location.

Observations made during the nine survey days tend to confirm the use by commercial vessels of established shipping routes to both the north and south of the FSRU, indicating that commercial barges and tankers will not be negatively impacted by the FSRU facility.

ATTACHMENT A

SAILING REGATTAS OBSERVED

Block Island Race Week (June 19-25, 2005)

The Block Island Race Week consists of four fleets and 29 races off Rhode Island's Block Island. Approximately 190 boats competed in 2005, with over 2,000 sailors participating. Specific course information for the Race Week could not be found.

Stratford Shoal Race (July 2, 2005)

The Stratford Shoal Race is hosted by the Riverside Yacht Club in Riverside, Connecticut. In 2005, the race had two courses, with the starting line located off Flat Neck Point. The first course was the 45-mile Stratford Shoal Light Course, and the second course was the 27-mile Cable & Anchor Course. Approximately 29 yachts participated in 2005. While the race traverses the proposed pipeline route, construction of the pipeline would not impact the race because construction would occur in the winter.

Around Long Island Regatta (July 28–30, 2005)

The 2005 Around Long Island Regatta included 88 boats in 10 sailing divisions. The Regatta began on the South Shore near Jones Beach, traveling east around Montauk and then heading west through the Sound to the finish line in Glen Cove, New York, completing a 190-nautical-mile lap around Long Island. The race started on Thursday afternoon and the first boat to reach Glen Cove crossed the finish line Friday night at 9:40 P.M. Because of the late finish in the Sound, the proximity of the specific sailboat routes to the proposed FSRU location was not determined. The width of the Sound in proximity to the proposed FSRU location minimizes potential impacts due to the expanse of water that can be sailed.

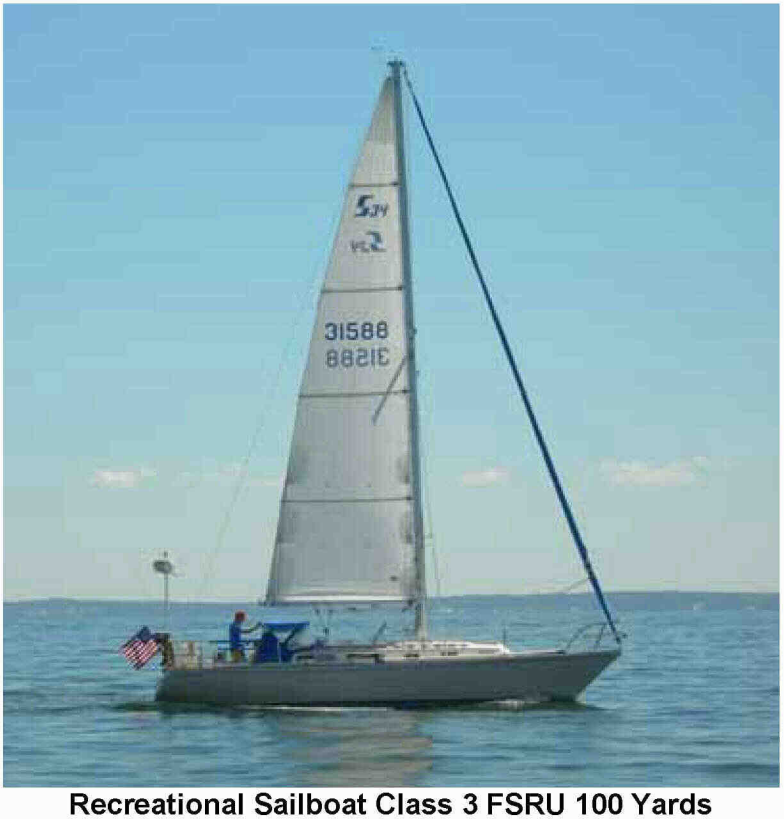
Vineyard Race (Labor Day weekend)

The 238-mile Vineyard Race starts in Stamford, Connecticut, runs out to the entrance of Buzzard's Bay, and returns back to Stamford, Connecticut. The race started Friday, September 2, and the earliest finishers crossed the finish line Saturday afternoon. Fifty-one boats participated in the Vineyard Race in 2005. The race coincided with the Labor Day weekend, and boating traffic in the Sound was general quite heavy during this period. Boating traffic in the vicinity of the proposed FSRU location was not significant, with a majority of the boats observed passing approximately 1 mile away.

ATTACHMENT B

PHOTOS OF REPRESENTATIVE BOAT TYPES

Sail Boat Class 3 at FSRU 15 yards (Vineyard Regatta – Labor Day)



Recreational Sailboat Class 3 FSRU 100 Yards

Commercial Barge and Tug Class 7 FSRU 500 yards

Commercial Barge and Tug Class 7 FSRU 1 mile

Commercial Lobster Boat Class 3 FSRU 1 mile

Recreational Powerboat Class 6 FSRU 300 yards

Recreational Powerboat Class 3 FSRU 300 yards

APPENDIX C

FISHERMEN OUTREACH

Fishermen Outreach

August 2005

Prepared for:

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1.0 INTRODUCTION

Broadwater Energy, a joint venture between TCPL USA LNG, Inc., and Shell Broadwater Holdings LLC, is filing an application with the Federal Energy Regulatory Commission (FERC) seeking all of the necessary authorizations pursuant to the Natural Gas Act to construct and operate a marine liquefied natural gas (LNG) terminal and subsea connecting pipeline for the importation, storage, regasification, and transportation of natural gas. The Broadwater LNG Project (the Project) will increase the availability of natural gas to the New York and Connecticut markets through an interconnection with the Iroquois Gas Transmission System (IGTS). The FERC application for the Project requires the submittal of 13 Resource Reports, with each report evaluating project effects on a particular aspect of the environment.

The proposed Broadwater LNG terminal will be located in Long Island Sound (the Sound), approximately 9 miles (14.5 kilometers [km]) from the shore of Long Island in New York State waters, as shown on Figure 1. The LNG terminal facilitates the sea-to-land transfer of natural gas. It will be designed to receive, store, and regasify LNG at an average throughput of 1.0 billion cubic feet per day (bcfd) and will be capable of delivering a peak throughput of 1.25 bcfd. The Project will deliver the regasified LNG to the existing interstate natural gas pipeline system via an interconnection to the IGTS pipeline. Onshore facilities are discussed in the Onshore Facilities Resource Reports.

The proposed LNG terminal will consist of a floating storage and regasification unit (FSRU) that is approximately 1,215 feet (370 meters [m]) in length, 200 feet (60 m) in width, and rising approximately 80 feet (25 m) above the water line to the trunk deck. The FSRU's draft is approximately 40 feet (12 m). The freeboard and mean draft of the FSRU will generally not vary throughout operating conditions. This is achieved by ballast control to maintain the FSRU's trim, stability, and draft. The FSRU will be designed with a net storage capacity of approximately 350,000 cubic meters [m^3] of LNG (equivalent to 8 billion cubic feet [bcf] of natural gas) with base vaporization capabilities of 1.0 bcfd using a closed-loop shell and tube

vaporization (STV) system. The LNG will be delivered to the FSRU in LNG carriers with cargo capacities ranging from approximately 125,000 m^3 up to a potential future size of 250,000 m^3 at the frequency of two to three carriers per week.

The FSRU will be connected to the send-out pipeline, which rises from the seabed and is supported by a stationary tower structure. In addition to supporting the pipeline, the stationary tower also serves the purpose of securing the FSRU in such a manner to allow it to orient in response to prevailing wind, wave, and current conditions (i.e., weathervane) around the tower. The tower, which is secured to the seabed by four legs, will house the yoke mooring system (YMS) allowing the FSRU to weathervane around the tower. The total area under the tower structure, which is of open design, will be approximately 13,180 square feet (1,225 square meters [m^2]).

A 30-inch-diameter natural gas pipeline will deliver the vaporized natural gas to the existing IGTS pipeline. It will be installed beneath the seafloor from the stationary tower structure to an interconnection location at the existing 24-inch-diameter subsea section of the IGTS pipeline, approximately 22 miles (35 km) west of the proposed FSRU site. To stabilize and protect the operating components, sections of the pipeline will be covered with engineered back-fill material or spoil removed during the lowering operation. The proposed pipeline route is shown on Figure 1.

The location and operation of the FSRU and installation of the proposed pipeline have the potential to impact both commercial and recreational fishing in the Sound. While the Sound is home to more than 100 species of fish, crustacean and shellfish, the commercial and recreational fishing industries generate their revenue from a few select species (USEPA 2005). In order to characterize the extent of current commercial and recreational fishing occurring in the Sound, and to identify potential impacts to these industries, a broad reaching stakeholder outreach program was implemented for the proposed Project.

To supplement the FERC application for the Broadwater Project, HDR• ŁMS, Inc. was tasked with collecting information on the commercial and recreational fishing activities conducted in

Long Island Sound. This information will be used to facilitate assessment of potential impacts resulting from construction and operation of the proposed Project.

2.0 METHODS

Assessment of the fisheries in Long Island Sound was completed through consultation with commercial and recreational fishermen and state and federal agencies involved in managing the Sound's resources. Information obtained from commercial and recreational fishermen included: areas fished in Long Island Sound, targeted species, gear type, seasons fished, approximate annual harvest, specific concerns related to the proposed Project, and names of additional contacts. Additional information regarding the Sound's fishery resources was obtained from the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries), New York State Department of Environmental Conservation (NYSDEC), Connecticut Department of Environmental Protection (CTDEP), the New York Seafood Council and the New York Sea Grant.

2.1 FISHERMEN OUTREACH

Consultations with individual commercial fishermen and recreational fishing entities were made primarily through telephone interviews using a snowball sampling method. Snowball sampling is a non-probability sampling method, which relies on referrals from initial subjects to generate additional subjects. While this technique is not appropriate for most sampling situations because it introduces a bias by reducing the likelihood that the sample will represent a good cross section from the population, it can be used to overcome the problems associated with sampling networks within populations. The method takes advantage of the social networks of identified respondents to provide additional relevant respondents (Thomson, 1997). While the information cannot be used to generalize beyond the sample, it is an effective way to solicit information in an open-ended fashion.

To assure that fisherman operating within the Project area waters were considered as part of this outreach program, a list of licensed commercial food fisherman in the Sound was obtained from

the NYSDEC. The list included all parties with current licenses, but did not provide information regarding actual fishing activities or the specific areas within the Sound fished by the license holders. Through various communications with NYSDEC personnel, key fisherman known to operate in the Project area were identified. The list of permitted fishermen was reviewed by Broadwater's Stakeholder Team, which made first contact with these fishermen in order to provide an introduction to the Project and inform them of the intended telephone interviews. Since Broadwater initiated a significant stakeholder outreach program soon after the Project announcement in November of 2004, Broadwater had already established relationships with many of the fishermen in the region.

Based on the permit list, 28 fishermen were initially contacted by Broadwater's Stakeholder Team with follow-up contact by HDR• ŁMS for purposes of telephone interviews to gather specific data. During the course of these interviews, fishermen were encouraged to provide names of other individuals/operators potentially fishing in the Project area. In addition, local lobster fishermen were also consulted for input on other fishermen potentially working in the Project area. As a result of the HDR• ŁMS interviews and stakeholder contacts in the lobster fishing community, 16 additional fishermen were contacted and interviewed as part of the survey.

In order to standardize the interview process and facilitate recording of answers, HDR• ŁMS developed an interview form in coordination with Ecology and Environment, Inc. and Broadwater Energy (Appendix A). Each interview covered the framework of questions presented on the interview form, as well as additional information volunteered by respondents. This report describes general patterns of fishing based on results of all respondents, as well as specific information for individual fishermen, when applicable.

2.2 AGENCY CONTACTS

HDR• ŁMS submitted a data request to NOAA Fisheries (Appendix B) for a list of commercial vessels that reported landings in Long Island Sound within the last two years, the species that were landed by these commercial vessels, and the weight of the landings of each species (by year

or by month). The area of interest in the Sound was defined using latitudinal and longitudinal coordinates (lat, long) for Asharoken, NY and Shorehaven, CT on the western end, and Roanoke Landing, NY and Sachem Head, CT on the eastern end (Figure 2).

In addition to the interviews and agency contacts, existing reports and publicly available data on commercial and recreational fishing activities in Long Island Sound were also obtained from NYSDEC and CTDEP, where possible. HDR• ŁMS also contacted the marine fisheries specialist for the New York Sea Grant in order to obtain additional information on commercial and recreational fishing activities in the Sound as they relate to Sea Grant's research and outreach activities. Finally, the New York Seafood Council was contacted in order to obtain information on the contribution of Long Island Sound fisheries to New York's seafood industry.

3.0 RESULTS

Forty-four telephone calls were made to commercial and recreational fishermen, resulting in 34 interviews. Five people did not return phone calls and five people declined an interview or were reluctant to provide information. Of the 34 people who participated in the interviews, 26 were strictly commercial fishermen, six were captains of party and charter boats, one was a commercial fisherman who also runs a party boat, and one was a recreational fishermen that does not fish in Long Island Sound. A table summarizing the results of each call is provided in Appendix C.

Information available through NOAA Fisheries, NYSDEC, CTDEP, and the New York Sea Grant regarding fishing activities in the Sound was also reviewed and is summarized below. Data from the New York Seafood Council were sought but were never obtained.

3.1 COMMERCIAL FISHERIES

3.1.1 Species fished and gear type

Lobster fishing has dominated the commercial fishing activities in Long Island Sound over the last 20 years (ENSR 2001). There is intensive use of fixed gear (lobster traps/pots) and limited use of mobile gear (trawlers/draggers).

Of the 26 commercial fishermen interviewed, 22 target lobster, either solely or in combination with other fish and shellfish species. All of the fishermen that target lobster use lobster pots or lobster traps. Eight of the fishermen responded that they harvest bycatch in the traps as well as lobsters. Blackfish is the most prevalent bycatch species followed by black sea bass. Porgies (scup), conch, squid, fluke (summer flounder) and flounder were also reported as bycatch.

Four of the 22 fishermen that target lobster use additional fixed gear to target finfish. These gear types include fish pots, fish traps, conch pots, nets, and hook and line. The fish pots are set to catch blackfish and the conch pots are set for conch. The fish traps, nets and hook and line are directed toward seasonally abundant species in the Sound. These species primarily include, but are not limited to, fluke, porgies, blackfish, bluefish, striped bass, squid, flounder and butterfish.

Four of the 26 interviewed commercial fishermen trawl (drag) for finfish in Long Island Sound. Like the fishermen using fixed gear, these fishermen target the finfish species that are seasonally abundant in the Sound. The fishermen reported tow lengths of 15 minutes to three hours, depending on the season, location, targeted species and harvest limits. One of these fishermen also targets lobster with fixed gear and the other three fishermen are exclusively trawlers.

One of the 26 interviewed commercial fishermen targets shellfish and fishes exclusively in nearshore Connecticut waters. Shellfishing is not prevalent in the Project area, with the vast majority of shellfishing conducted in the shallow nearshore waters of the Sound. Five of the commercial fishermen indicated that the Project area is too deep for bottom cultures or

clammers. A sixth fisherman stated that while there may be a lot of clams in the area, fishermen are restricted from harvesting clams in the deeper waters of the central Sound.

3.1.2 Fishing season

Of the 19 fishermen that reported their fishing seasons, the majority (18) fish 12 months of the year. Seven lobster fishermen gave specific details as to seasonal patterns within the 12 months of fishing. The patterns were relatively similar, with two peak fishing periods for lobster, one during the spring and summer and another during late fall/early winter. Heavy fishing begins in February, March or early April and continues through August. Fishing slows until the second peak period begins in late October or November and continues through December. Most fishermen reported lighter activity in the winter, but fishing continues, especially if the winter is mild. The fisherman that uses both fixed gear for lobster and a trawl to target finfish follows the general seasonal pattern for lobster and focuses his dragging effort during May and June and also during September and October. One of the fishermen that trawls for finfish and does not maintain fixed gear reported specific time periods for trawling in the Project area. These include mid- April through mid-May, late summer (August), and December through January.

3.1.3 Annual harvest rates

Only five of the 26 commercial fishermen provided estimates of their annual harvest. Most were concerned about improper use of harvest data in management decisions. Two fishermen indicated that before the lobster die-off in 1999, annual harvests yielded greater than one million dollars per year. One fisherman gave a very rough estimate of an average harvest of 65,000 lbs of lobster per year, ranging from 40,000 lbs to 100,000 lbs per year. Only two fishermen reported estimates of income generated from fishing in the Project area, and the estimates depended on the amount of time spent in the area and level of fishing effort. One fisherman estimated income from the Project area as at least $2,000.00 per day and the second fisherman reported that $30,000 to $40,000 per year could be generated from the area.

3.1.4 Fishing areas

Fishermen that target lobster indicated that they work in specific areas and that there is a cooperative agreement between lobstermen working in Long Island Sound as to the boundaries of these fishing areas. The density of lobster pots/traps is very high in some areas (Figure 3) and cooperation is necessary in order to maintain harmony among the fishermen.

A gentleman's agreement also exists between lobstermen and trawlers (draggers) in order to avoid damage to both fixed and mobile gear. The agreement designates specific lanes for trawlers in which no fixed gear is placed. The lanes were explained in detail by two fishermen and were referenced in terms of Loran lines. Loran C lines represent the distances (radii) from a Loran C station broadcasting a signal. Fishing vessels have receivers that translate the time-signal broadcast into distance from the station. The fishermen indicated that there are two lanes, approximately 8 to 12 miles long and one quarter of a mile wide, off of the coast of Connecticut. The trawling lanes run east and west. The western-most end of the trawling lanes is off of Milford, Connecticut and corresponds to the "72" longitude line and Loran line 15080.0. Loran line 43970.0 is the southern boundary of the trawling lanes. One of the fishermen also referred to a trawling lane in New York waters, between Loran lines 43960.0 and 43963.0. However, this fisherman was unsure of the western boundary of this trawling lane and if the lane was still in use.

Results of the interviews indicated that the pipeline portion of the proposed Project is located in an area that is heavily fished for lobster. The proposed location of the FSRU terminal is an area that is primarily fished for lobster, but also bounds identified trawling areas. The size of the security (exclusion) zone will determine the extent of impacts to these fishermen. A map of the trawl lanes in relation to the proposed Project area is provided in Figure 4. Twenty of the 26 commercial fishermen interviewed may be affected by the Project, based on their reported fishing area, although the great majority would only experience temporary disruption during the construction of the marine pipeline. Two of these fishermen reported that they would not be affected by the Project, but based on their descriptions of their fishing areas, their fishing activities likely would be temporarily disrupted by construction of the pipeline portion of the

Project. Of these 20 fishermen, four reported fishing in the general Project area, 11 fish in the area of the proposed pipeline, and five fish in the area of the proposed FSRU terminal.

3.1.5 Project-related concerns

Most concerns regarding the proposed Project were related to fishing areas. The majority of the affected fishermen (15 out of 20) have fixed gear in the vicinity of the pipeline. Most of these fishermen are concerned about the timing of pipeline construction and the loss of income if their gear has to be pulled, especially if construction occurs during times of peak fishing. One fisherman indicated the use of over 1,000 traps in the area. Another primary concern of these fishermen involves the possible loss of the fishing grounds in the area of the proposed FSRU terminal and potential for an associated security zone. Other general concerns raised by the fishermen included environmental (bottom disturbance during construction) and safety (a potential accident in the Sound) issues.

Assuming that fishermen are excluded from the terminal area and associated security zone, five individuals expressed concern that the historic operational practices throughout the Sound might affect the displaced fishermen's ability to relocating to other areas in the Sound. One fisherman indicated that 30-50% of his income is generated from the Project area and another fisherman has both fixed gear and trawl lanes in the area. A specific concern identified by the trawlers is the potential for the exclusion zone of the FSRU terminal to eliminate portions (3-4 miles) of the recognized trawl lanes in the Sound.

3.1.6 Commercial landings data

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) provided preliminary landings data for Long Island Sound between land coordinates (latitude, longitude) that encompass the Project area (Figure 2). The catches, in live pounds, for twenty fish species collected from May 2002 through April 2003 and May 2003 through April 2004 (2 fishing years) are listed in Table 1.

Table 1
Species and Total Live Pounds of Fish Harvested in the Long Island Sound Commercial Fisheries during the 2002 and 2003 Fishing Seasons as Provided by the National Oceanic and Atmospheric Administration*

Species	Live Pounds
Angler	43,680
Scup	40,733
Bluefish	14,827
Flounder, Summer	12,513
Lobster	5,394
Tautog	3,642
Butterfish	3,527
Squid (Loligo)	1,810
Skates	1,767
Sea Robins	1,222
Sea Bass, Black	1,093
Flounder, Yellowtail	770
Flounder, Winter	572
Bass, Striped	272
Dogfish Smooth	189
Hake, Red	92
Croaker, Atlantic	26
Eel, Conger	25
Bonito	12
Flounder, Sand-Dab	4

*All records are from Federal Permit numbers that possess a permit with a federal reporting requirement.
Data are preliminary.
The landings data were collected from the following areas:
West End: 040 57 25.79 N 073 23 34.75 W / 041 04 53.73 N 073 23 44.61 W
East End: 040 58 40.11 N 072 42 35.91 W / 041 14 29.59 N 072 41 59.59 W

The species contained in Table 1 are generally consistent with the species reported to be landed by the fisherman contacted during the phone interviews. For example, commercial fishermen interviewed reported harvesting scup, bluefish, summer flounder and lobster among others on the list. Angler (also called monkfish and goosefish), which according to NOAA Fisheries was the most harvested species in the area, was not reported to be targeted by those interviewed.

Anglerfish can be found in shallow estuarine areas, but are generally found on the continental shelf and slope, in water depths of 70 to 100 meters. Thus, it is possible that the anglerfish reported in the NOAA landings data were caught outside of Long Island Sound.

The landings data provided by NOAA Fisheries must be considered only a subset of the total catch data. Long Island Sound is considered state jurisdictional waters, and as such, there is no federal requirement for vessels fishing solely in Long Island Sound to file vessel trip reports with NOAA Fisheries. Additionally, because the land coordinates used to generate the landings data are for an area much larger than the Project area, and federally required vessel trip reports require only an "average" single-point location for the entire fishing trip, the NOAA data may encompass significant fishing grounds beyond the bounds of the Project area. Neither NYSDEC nor CTDEP produce formal reports on commercial data. Both agencies recommended that NOAA Fisheries be contacted for landings specific to the Sound.

New York Sea Grant indicated that they do not have any information specific to Long Island Sound fisheries. The New York Sea Grant report "Economic Analysis of the Contribution of Sport Fishing, Commercial Fishing, and Seafood to the New York State Economy" does not address Long Island Sound specifically.

3.2 RECREATIONAL FISHERIES

3.2.1 Party and charter boat fishing

Six captains of party and charter boats were interviewed. One commercial fisherman that runs a party boat was also interviewed. Rod and reel is the type of gear used by all of the boats and the captains target different species depending on the season. These species include fluke, blackfish, bluefish, striped bass, porgies, flounder, and black sea bass. Trips to eastern Long Island Sound target codfish and pollock, in addition to the other species. The interviewed captains access all parts of the Sound, including the Project area.

Those captains that charter trips within the Project area (3) operate from April through December. One captain reported fishing at shipwrecks in the area during April and May and September through December, spending a substantial amount of time in the area during the fall season. The charter and party boats carry from 20 to 100 people per trip and several of the interviewed captains have multiple boats.

Concerns of the charter and party boat captains regarding the Project were similar to those voiced by the fishing industry, specifically loss of fishing grounds around the FSRU terminal, exclusion zones associated with the FSRU and incoming LNG carriers, and general environmental concerns associated with accidental releases of LNG. One captain raised the issue of the possibility of special permits to provide limited access. A concern raised by party boat captains, but not the commercial fishermen, involved the ability to anchor over the pipeline, since party and charter boats either drift or anchor in the fishing area.

3.2.2 Recreational landings

As described in detail below, the CTDEP conducts an annual study of the Long Island Sound recreational fisheries. Alternatively, the NYSDEC does not collect data on recreational fisheries in Long Island Sound and does not typically fund studies of finfisheries specific to the Sound. New York Sea Grant also did not have any information on recreational fisheries specific to Long Island Sound.

The CTDEP conducts a yearly study of marine recreational fisheries in Connecticut which includes a Marine Angler Survey. This survey consists of both a Marine Recreational Fishery Statistics Survey and a Volunteer Angler Survey. The former involves a random telephone survey of households and an intercept survey of anglers at fishing sites, and the latter involves the use of data that fishermen record in logbooks which are submitted to CTDEP (CTDEP 2004).

The Marine Recreational Fishery Statistics Survey (MRFSS) indicated that an estimated 464,997 marine anglers made 1,537,899 trips in 2003 (CTDEP 2004). The three principal modes of marine recreational fishing included: fishing from shore (40%), fishing from privately owned or

rental boats (56%), and fishing from party and charter boats (4%). An estimated 6,095,304 fish were caught in 2003 and creeled catch was estimated as 2,528,379 fish. Scup (porgy) was the most frequently creeled fish, followed by bluefish, summer flounder (fluke), tautog (blackfish), and striped bass (Table 2). These five species comprised approximately 94% of the total creeled catch. In 2003, winter flounder comprised only 0.9% of the creeled catch, which was the third lowest recorded catch estimate since 1981.

The Volunteer Angler Survey report revealed that the most common fish targeted (number of trips) during recreational fishing included: striped bass, bluefish, summer flounder, tautog, scup, and winter flounder (Table 2) (CTDEP 2004). Approximately 117 trips targeted black sea bass, but this species also appeared to be frequently caught by recreational fishermen as incidental catch. Thirty-nine trips targeted weakfish, but only six fish were caught, suggesting very low abundance. Trips targeting scup were the most successful, followed by trips for summer flounder, tautog, winter flounder, bluefish, and striped bass (Table 2).

Table 2
CTDEP Recreational Fishery Survey Results 2003.

Species	MRFSS	Volunteer Angler Survey	
	% of Creeled Catch	# of Trips	Success Rate
Striped bass	4 %	2936	83 %
Bluefish	18 %	1437	84 %
Fluke	6.5 %	975	92 %
Blackfish	6.5 %	307	89 %
Porgy	59.4 %	269	98 %
Flounder	0.9 %	117	86 %

Another source of recreational landings data is the NOAA Fisheries Marine Recreational Fisheries Statistics Survey (http://www.st.nmfs.gov/st1/recreational/index.html). This survey was developed to provide government agencies, scientists, and the public with reliable estimates of the recreational fishery harvest as far back as 1979. For the purposes of this report, the NOAA Fisheries database was queried for recreational landing in inland waters, defined as "inshore saltwater and brackish water bodies such as bays, estuaries, sounds, etc. It does not include inland freshwater areas". Thus, the data include recreational landings from all inshore

saltwater areas in New York and Connecticut and are not limited to the Project area. Data were queried for the A and B1 fisheries, defined as "fish that are brought back to the dock in a form that can be identified by trained interviewers" and "fish that are used for bait, released dead, or filleted -- i.e. they are killed but identification is by individual anglers." for each of CT and NY during 2003 (Table 3).

According to the NOAA Fisheries Marine Recreational Fisheries Statistics Survey, recreational landings from NY and CT exceeded 15 million pounds during 2003 (Table 3). Bluefish, scup, striped bass, and summer flounder account for the vast majority of the landings in both states. While the top species harvested in CT according to NOAA Fisheries are consistent with those reported by CTDEP (2004), the total landings are more than twice those reported by CTDEP (2004). One possible reason for this discrepancy is that while CTDEP (2004) relies on only an intercept survey to estimate total landings, NOAA Fisheries relies on that same intercept survey and a telephone survey.

Table 3
Species and Weight (lbs) of Recreational Fishery Harvest from Connecticut and New York during 2003 (PSE, or proportional standard error, expresses the standard error of an estimate as a percentage of the estimate and is a measure of precision.)*

Connecticut			New York		
Species	Weight (lbs)	PSE	Species	Weight (lbs)	PSE
BLUEFISH	1,685,866	12.8	SCUP	4,508,447	11.4
SCUP	1,528,390	14.3	SUMMER FLOUNDER	2,027,840	10.7
STRIPED BASS	1,251,538	14	BLUEFISH	1,631,444	13.7
TAUTOG	603,862	19.4	STRIPED BASS	772,816	17.6
SUMMER FLOUNDER	410,708	14.1	WINTER FLOUNDER	289,766	19.3
HERRINGS	100,622	30.6	TAUTOG	232,477	35.8
WINTER FLOUNDER	25,803	36.7	BLACK SEA BASS	56,905	33.1
DOGFISH SHARKS	12,189	52	HERRINGS	48,940	49.9
WHITE PERCH	11,407	62.8	WEAKFISH	37,106	57.8
BLACK SEA BASS	6,515	40	DOGFISH SHARKS	29,482	73.3
SEAROBINS	5,079	54.6	SEAROBINS	16,614	64.3
LITTLE TUNNY/ATLANTIC BONITO	4,616	100	PUFFERS	3,728	77.8
WEAKFISH	3,536	99.7	WHITE PERCH	3,214	77.1
CUNNER	1,515	46.7	OTHER CODS/HAKES	2,564	0
EELS	0	0	TRIGGERFISHES/FILEFISHES	1,693	62.3
SCULPINS	0	0	KINGFISHES	1,323	100
FRESHWATER CATFISHES	0	0	CUNNER	1,177	100
OTHER FLOUNDERS	0	0	OTHER FLOUNDERS	1,131	99.9
OTHER FISHES	0	0	EELS	0	0
OTHER TUNAS/MACKERELS	0	0	SCULPINS	0	0
SKATES/RAYS	0	0	FRESHWATER CATFISHES	0	0
OTHER SHARKS	0	0	TOADFISHES	0	0
-- Grand Total --	5,651,646	6.7	OTHER FISHES	0	0
			OTHER TUNAS/MACKERELS	0	0
			LITTLE TUNNY/ATLANTIC BONITO	0	0
			SKATES/RAYS	0	0
			OTHER SHARKS	0	0
			-- Grand Total --	9,666,666	6.5

*Zero catch indicated catch of <500 lbs

4.0 SUMMARY

4.1 COMMERCIAL FISHERIES

The majority of interviewed commercial fishermen (> 90%) target lobster with fixed gear (lobster pots/traps). This corresponds with reports of lobster fishing dominating the commercial

fishing industry in Long Island Sound. Approximately half of the lobster fishermen only target lobster and half also harvest finfish either as bycatch or by fishing with fixed gear, such as fish pots and nets. Finfishing activities in Long Island Sound are seasonally selective. Trawling (dragging) activities appear to be limited in Long Island Sound, as only three trawlers (draggers) were identified during the interview process.

Based on anecdotal information from the interviewed fishermen, shellfishing activities within the Project area are minimal to non-existent. The fishermen indicated that scallop fishing does not occur in Long Island Sound and bay scallops are limited to a few shallow, nearshore bays.

The seasonal fishing activities were similar for all interviewed commercial fishermen. Most fish 12 months out of the year, with the heaviest fishing for lobster occurring in late spring, summer, late fall and early winter. Few fishermen were comfortable sharing estimates of their annual harvest.

Lobstermen target specific areas for their fishing activities and these areas are respected by other lobstermen. There is also an informal agreement between lobstermen and trawlers that designates specific lanes for trawling, in which no lobster gear is placed. The proposed Project may affect fixed gear in the vicinity of the pipeline and both fixed gear and trawl lanes in the vicinity of the FSRU terminal. A large proportion of the commercial fishermen interviewed (20 of 26) believe that they may be affected by some component of the Project, either the FSRU or the marine pipeline. Most of these fishermen (15 of 20) reported that they conduct their fishing activities in the area of the proposed pipeline. The primary concern of these fishermen involved construction activities, specifically the removal of fixed fishing gear to allow pipeline installation and the timing of construction with respect to peak fishing periods. Fewer fishermen (5 of 20) indicated that they utilize the area of the proposed FSRU terminal. These fishermen were primarily concerned that their fishing activities would be affected by the size of the security (exclusion) zone around the terminal.

4.2 RECREATIONAL FISHERIES

The primary concerns of the charter and party boat captains include the loss of fishing grounds around the proposed FSRU terminal and associated security zone and the ability to anchor over the proposed pipeline. Targeted species depend on the season and are similar among the captains. These species correspond to the most commonly targeted and caught species reported by the CTDEP and include scup (porgies), summer flounder (fluke), bluefish, striped bass, blackfish (tautog) and flounder.

5.0 REFERENCES

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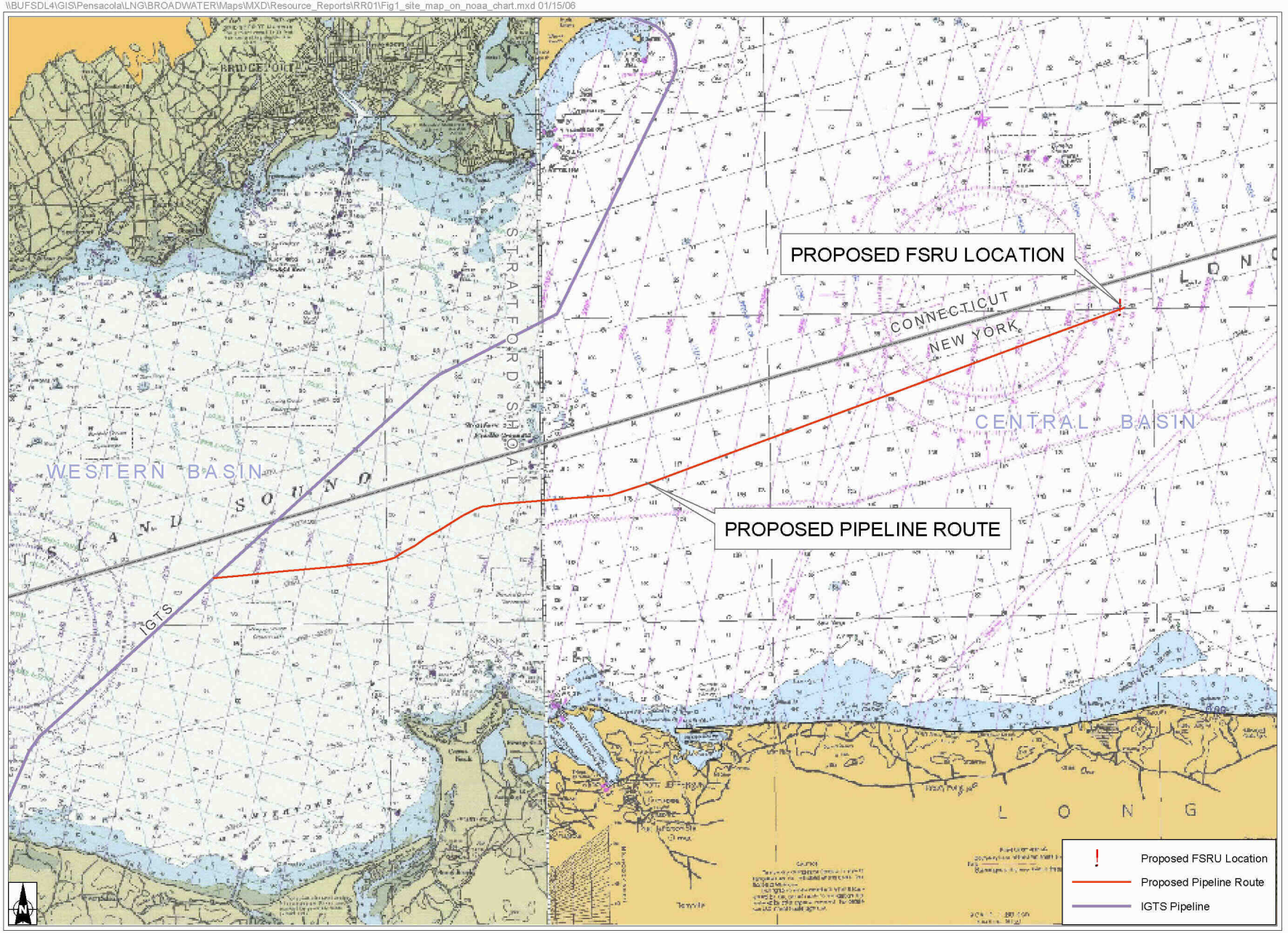
Thomson, S. 1997. Adaptive sampling in behavioral surveys. NIDA Research Monograph 296-319.

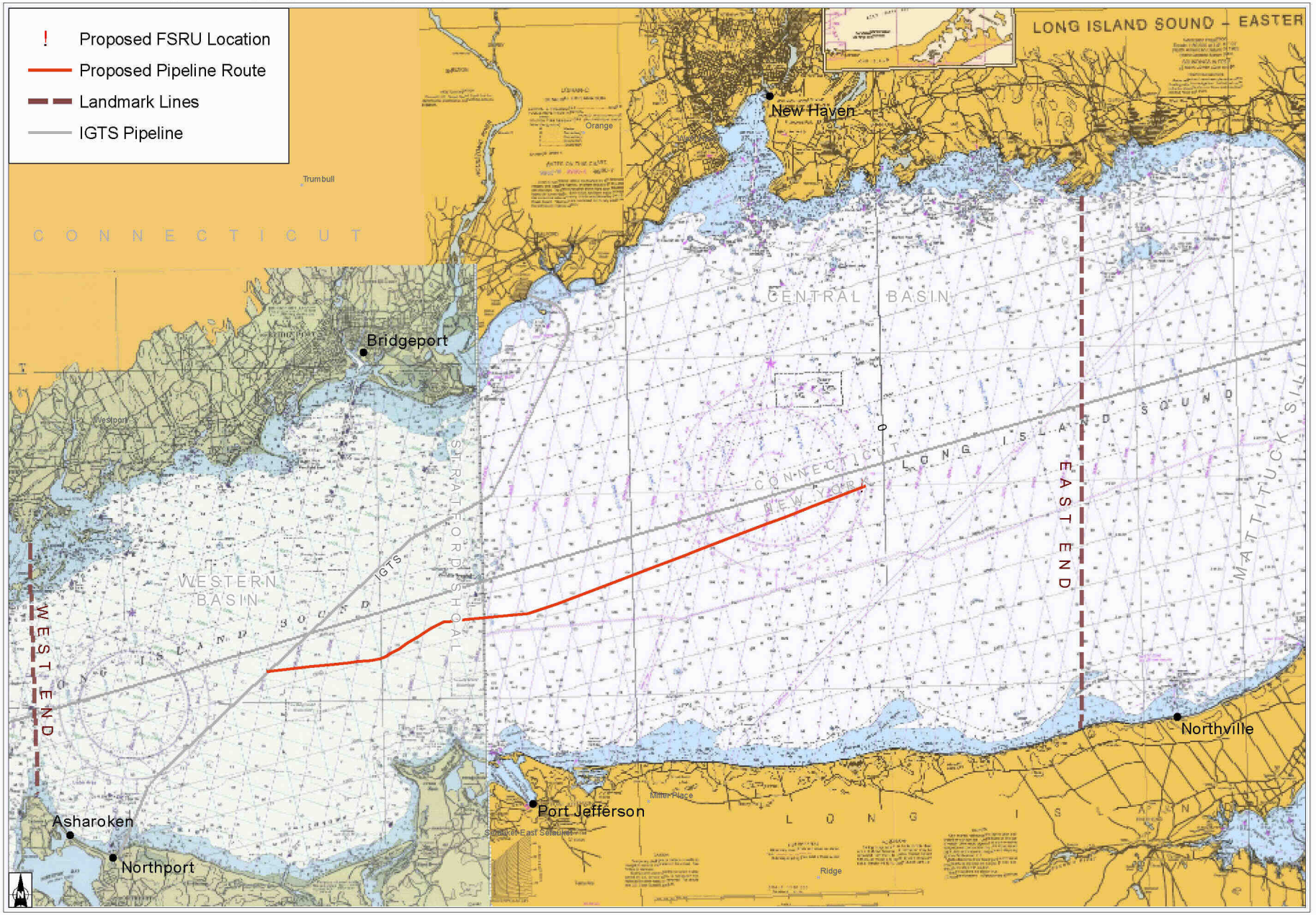
United States Environmental Protection Agency. 2005. Long Island Sound Facts, Figures & Maps. In Region 1: New England. http://www.epa.gov/region01/eco/lis/facts.html. Last Updated May 13, 2005. Visited June 3, 2005.



Source: NOAA Charts 12354 (July, 2003), and 12363 (July 15, 2000).

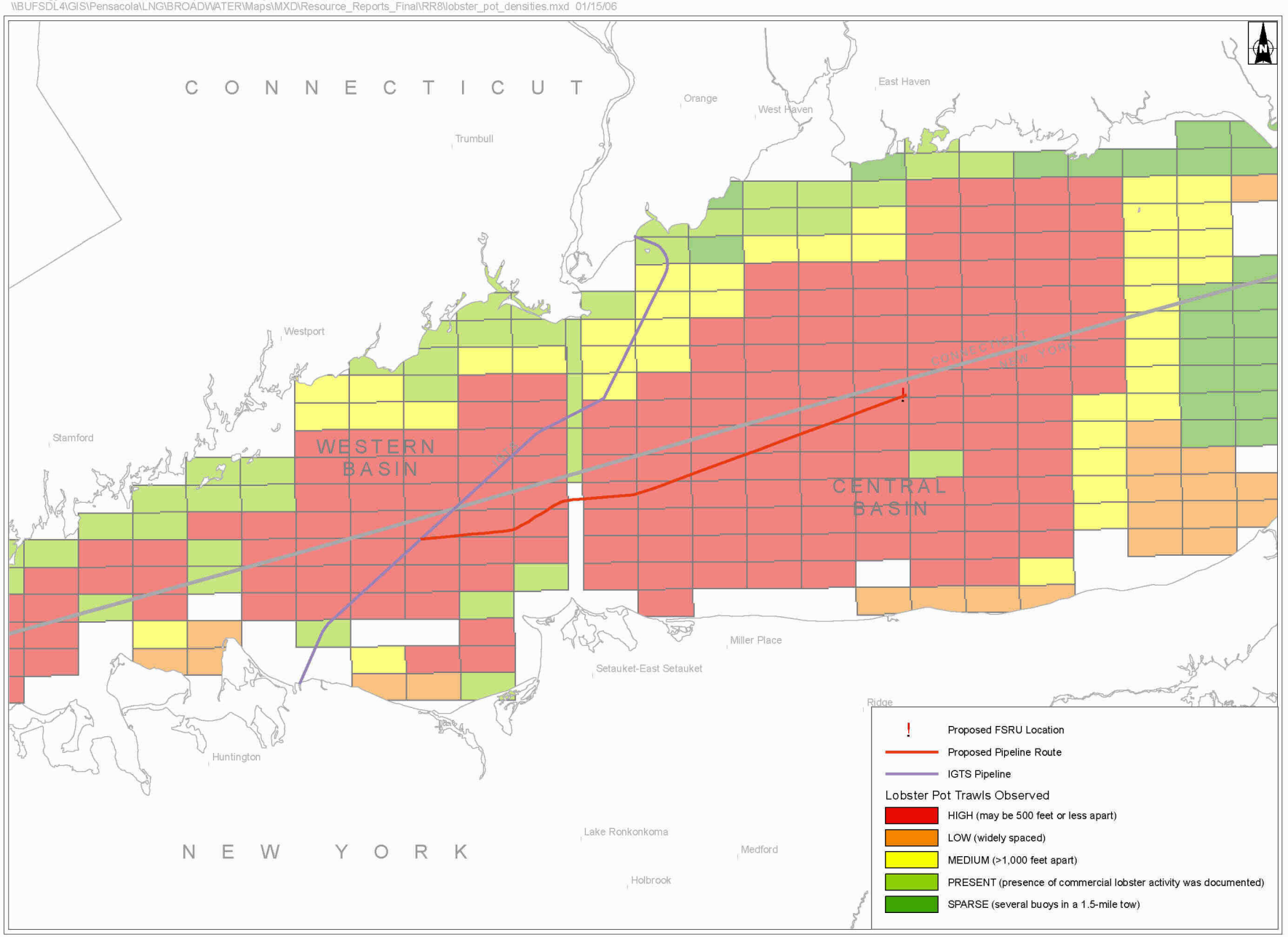
0 2.5 5 10
Miles

Figure 1 Proposed FSRU Facility Location and Proposed Pipeline Route



Source: U. S. Geological Survey Open-File Report OFR 00-304, 2000,
U. S. NOAA Electronic Nautical Charts.

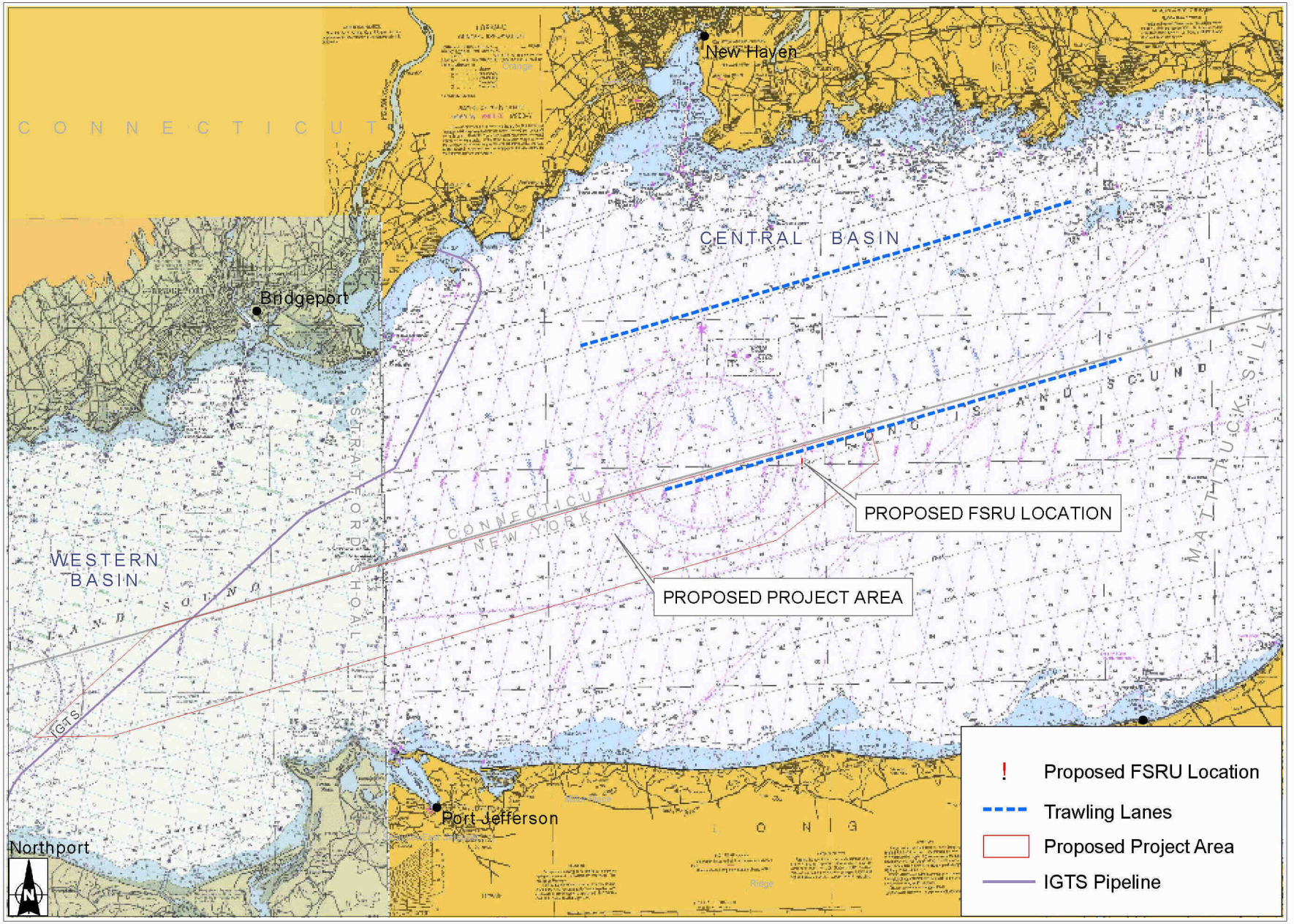
Figure 2 Locations of Boundaries used for NOAA Landings Data



Source: Connecticut Department of Environmental Protection, 2004.

Figure 3 Density of Lobster Pots in Long Island Sound

\\BUFSDL4\GIS\Pensacola\LNG\BROADWATER\Maps\MXD\Resource_Reports_Final\RR8\Fig2_NOAA_Landmark_Lines.mxd 01/15/06



Source: Trawl Lane Locations (Loran Lines 43970 to 43973, 15070 to 15 Miles East, New York and Loran Lines 44010 to 44012, 15080 to 14955, Connecticut) provided by Broadwater Stakeholder Team, 2005,
U. S. Geological Survey Open-File Report OFR 00-304, 2000,
U. S. NOAA Electronic Nautical Charts.

0 2.5 5 10
Miles

Figure 4 Proposed Project Area and Locations of Trawling (Dragging) Lanes

Appendix A

Contact Protocol for Commercial and Recreational Fishermen

Broadwater Liquefied Natural Gas Terminal
Recreational and Commercial Fisherman Contact Protocol

The protocol described below assumes that the proposed Broadwater Liquefied Natural Gas Terminal has already been described to the contact in some detail by the Broadwater Stakeholder Team. The stakeholder team representative will ask the contact for their mailing address or email for sending any project material. The contact will be provided with a map of the proposed project area. The following information is open for discussion during the calls:

- Broadwater Energy is a joint venture between Shell US Gas and Power, LLC, and TransCanada Pipeline USA Ltd.
- Following two years of research and analysis, Broadwater has developed plans to import liquefied natural gas to a terminal at a proposed location about nine miles off the coast of Riverhead, New York (about 11 miles from the nearest Connecticut shoreline). The terminal would connect with the existing subsea Iroquois Gas Transmission system (Iroquois) pipeline via an underwater connecting pipeline that would be about 25 miles long.
- The gas pipeline would most likely be installed beneath the seabed. Geotechnical and geophysical investigations to determine seabed conditions and the best method for pipeline installation are currently underway. One of the goals of this outreach effort is to discuss how the pipeline installation could temporarily affect your activities in the sound.
- Physically, Broadwater would consist of a ship-like vessel moored in Long Island Sound. The vessel, known as a Floating Storage Re-gasification Unit, or FSRU, would be about 1,200 feet long and 180 wide about the size of the Queen Mary II cruise ship. The deck would rise about 50 feet above the water. The FSRU would receive liquefied natural gas shipments from ocean-going carriers every two to three days. The carriers would enter the Sound and offload their cargo as many ships do today in the region.
- The FSRU would be constructed at a shipyard, towed to a site in the Sound, and attached to a yoke mooring system. The yoke mooring system would be supported by a tower structure attached to the floor of the Sound. (Note although the mooring tower base will cover an area the size of a basket ball court, the only part to touch the floor of the sound would be the four tower legs. The FSRU would pivot around the mooring tower.
- The current schedule forecasts that the first delivery of liquefied natural gas would occur in 2010.
- Broadwater has been working with the lobstermen in the area during the ongoing geotechnical and geophysical survey work to ensure minimal disruption to their fishing activities.

In the event that additional information is requested, the interviewer will provide contact information for the Broadwater Stakeholder Team.

Interview Protocol
The below is to be used as a general template for the phone interviews of Commercial and Recreational fishermen.

Contact Information

Name _____

Affiliation _____

Phone Number _____

Date/Time of Call _____

Introduction: Good morning, my name is _____. I am calling from LMS Engineers in Pearl River, New York on behalf of Broadwater Energy. I understand that you have already been contacted by Broadwater regarding their proposed liquefied natural gas terminal for Long Island Sound and that they also made you aware of the Finfisherman Outreach Program for which I am calling. Do you have a few minutes to talk with me about this today?

If the answer is "no," then:

Would another time work better for you?

Note response here:

If "yes," then:

Broadwater is very interested in working with you and with other fishermen to minimize impacts to your activities in the sound as a result of this construction phase in the project. We are hoping to work with you throughout this regulatory review process and as the project moves forward.

Your input is vital in that it will both help Broadwater design a project that is compatible with fishing operations in the Sound and also make certain that *any* potential impacts to fishing operations are included in the review process for state and federal permit applications.
Did you receive the package that was sent to you?

Note response here:

Have you had a chance to review the map of the project area?

[Expect that if they have, they will give some indication of the potential for impacts based on the project area]

Note response here:

Do you currently or are you aware of anyone who is fishing in that area and could be affected by the project?

Note response here:

Question 1: Where in Long Island Sound do you concentrate your fishing effort?

Note response here:

Question 2: What species do you target when you fish in Long Island Sound?

Note response here:

Question 3: What type of gear do you use to target these species? [This may be modified based on what species are being fished]

Note response here:

Question 4: During what months of the year do you fish?

Note response here:

Question 5: Are you comfortable sharing with me an estimate of the annual harvest rates that are typical for each of the species you target?

Note response here:

Question 6: Is there any other information relevant to Long Island Sound fisheries that you think I should be aware of?

Note response here:

Question 7: Is there anyone else that you suggest I contact?

Note response here:

Closing: That is all of the questions I have. Thank you very much for taking the time to talk with me today. We would be happy to send you a Shell gas card in appreciation of your time. Would you like me to send you one? [Take contact information]

Note response here:

Again, thank you for your time and input. We look forward to coordinating further with you on this project. If you have any questions or require additional information, please feel free to contact Froydis Cameron, at 631 208 8344 or Hubert Harrell, at 631 208 8345 or 1-800-789-6379. Again, my name is _____ and I can be reached at 1-845-735-8300.

Appendix B

Data Request Submitted to NOAA Fisheries

April 12, 2005

NOAA Fisheries Service
Northeast Regional Office
One Blackburn Drive
Gloucester, MA 01930-2298

Re: Request for information regarding commercial landings in Long Island Sound

Dear NOAA Fisheries Service:

Lawler, Matusky & Skelly Engineers LLP (LMS) is working to develop a finfisherman outreach program associated with a proposed natural gas import terminal and pipeline in Long Island Sound. The goal of the outreach program is to work closely with both commercial and recreational fishermen in order to address potential areas of conflict between the fisheries and the proposed project.

We are in the process of characterizing the commercial and recreational finfisheries in Long Island Sound, focusing on the proposed project area. To assist in this process, we are requesting information about the commercial landings in Long Island Sound. The data we would like to obtain include:

- A list of commercial vessels that reported landings in Long Island Sound within the last two years. If possible, vessels with landings specific to the area of the Sound between Asharoken, NY and Shorehaven, CT on the western end and Roanoke Landing, NY and Sachem Head, CT on the eastern end.

- The species that were landed by these commercial vessels

- The weight of the landings of each species (by year or by month).

Please include any additional information that might be readily available and relevant to the outreach (e.g., gear type, vessel size, contact information, restricted areas, etc.).

We would greatly appreciate your fulfillment of this request. If you have any questions, please contact me at either 845-735-8300 ext. 295 or mraffenberg@lmseng.com. Thank you for your assistance.

Sincerely,

Matthew J. Raffenberg

HDR | LMS
Henningson, Durham & Richardson Architecture and Engineering, P.C.
in association with HDR Engineering, Inc.

One Blue Hill Plaza
Floor 12
Pearl River, NY 10965-3104

Phone: (845) 735-8300
Fax: (845) 735-7466
www.hdrinc.com

Appendix C

Results of Telephone Interviews with Commercial and Recreational Fishermen

No.	Interview?	Industry	Impact?	Fishing Area		Species targeted		Gear	Fishing season		Annual Harvest	Main Concerns	Other comments	Contacts
				General	Specific	General	Finfish specifics		General	Specific				
1	Yes	Comm.	No	East of project area		Finfish	Squid, porgies, fluke, flounder, bluefish, butterfish, conch	Trawl, 45 min to 3 hr tows				Ship transit into sound, size of security zone		Yes
2	Yes	Comm.	Yes	General project area	Fishes heavily in project area, Stratford Shoal to 500 Line	Lobster + bycatch and finfish	Blackfish (bycatch and target)	Lobster pots/traps, fish pots	12 months	Feb to Aug. Nov until 38°, sometimes through winter, Feb-May is prime time	Prior to last 2 years, > $1 million per year	Loss of income if gear has to be pulled during prime time, fishing around terminal	A lot of clams, but not allowed to harvest	
3	Yes	Comm.	Yes	Pipeline area	Near Iroquois pipeline	Lobster + bycatch	Blackfish, black sea bass (bycatch)	Lobster pots/traps	12 months			No problems, but people who fish near terminal will be upset with security zone	No clammers, too deep, surf clams may come and go	
4	Yes	Comm.	Yes	Pipeline area	NYC to Port Jefferson	Lobster		Lobster pots	12 months			None		
5	Yes	Comm.	No?	Pipeline area?	Areas 3 and 4 off Stamford and Huntington Harbor	Lobster		Lobster traps	12 months			None	Too deep for clammers	Yes
6	Yes	Rec., Party Boat,	No	West of project area	West of Iroquois pipeline	Finfish	Flounder and blackfish (spring), scup, bluefish, striped bass (summer), blackfish (fall)	Rod and reel	St. Patrick's Day to early Dec.		Carries 12,000 people per year	None		Yes
7	Yes	Comm.	Yes	General project area	Gear is right in area	Lobster + bycatch	Blackfish (bycatch)	Lobster pots				1,000 traps in area, referred to Froydis for lobster outreach		
8	Yes	Comm., Head of CT Lobsterm an Assoc.	Yes	Terminal area	Himself and 6-8 other fishermen in area	Lobster		Lobster pots	10 - 12 months			30-50% of income is from terminal area, when terminal goes in lobstermen will be displaced, established areas, nowhere else to go	No impact to clams. Explained trawl lanes. Temperature dictates fish species. No scallop fishing in Sound	Yes
9	Yes	Comm.	Yes	Pipeline area	Western end of pipeline area	Lobster		Lobster traps	12 months	Start fishing heavily in March or April, heavy in summer 7x/week for 90 days, another peak Nov. through Dec.	40,000 to 100,000 lbs lobster, average 65,000 lbs. Rough estimate. Recovering from die-off.	Loss of income during construction phase when gear is pulled - should not be during peak fishing. Platform and buffer zone will cause fishermen to lose their areas forever. Cannot be recovered. compensation.		

Public

No.	Interview?	Industry	Impact?	Fishing Area		Species targeted		Gear	Fishing season		Annual Harvest	Main Concerns	Other comments	Contacts
				General	Specific	General	Finfish specifics		General	Specific				
10	Yes	Comm.	Yes	Pipeline area	Northport Harbor is home, runs Nissquogue R. to East, also passes Stamford, CT and Oyster Bay	Lobster		Lobster traps	12 months			Worried about accident in Sound		
11	Yes	Comm.	Yes	Terminal area	Substantial amount of gear and trawl lanes	Lobster + Finfish	Fluke, porgies, sea bass, blackfish, butterfish, squid, flounder, bluefish, all species that enter Sound	Lobster pots and trawl (combo vessel), 15 min (summer) to 2 hr (winter) tows	12 months	Less activity in winter, increases end of March, April to Aug and Nov/Dec are peaks for lobster, drags Sept/Oct and May/June	Difficult to separate areas. Could do it with more time. Also depends on price. Income from just terminal area could be $2,000/day easily.	Has gear and lanes near proposed terminal, if fishermen are excluded, how will they compensate. The area is staked out, can't place gear in someone else's spot. Not opposed, but must compensate for income.		Yes
12	Yes	Rec., Charter Boat	No	West of project area	Near bridges	Finfish	Striped bass, bluefish, flounder, fluke, blackfish	Rod and reel	Sping through Fall		6 people / trip	None		
13	Yes	Comm.	Yes	Pipeline area	Fishes in project area, Western section	Lobster		Lobster pots/traps	12 months	March - Aug heaviest, Winter months are lightest		Area around terminal, security zone, will people be excluded from fishing there		
14	Yes	Comm., President Western Lobster Assoc.	No	West of project area	Eaton's Neck and West	Lobster + bycatch	Blackfish, black sea bass (bycatch)	Lobster traps	12 months			If there is a security zone of 1 mile around terminal, people will be displaced from fishing areas, may move traps into other areas and create a ripple effect toward West		
15	Short, angry												A few draggers in the area, no clams for 5 miles.	
16	Yes	Rec., Party Boat	No	East of project area	In Race Area, S. of Fisher's Island	Finfish	Striped bass, codfish, polluck, bluefish	Rod and reel	June - Oct		150 passenger rig	Size of security zone around tankers entering Sound, method for warming liquid to gas		
17	Yes	Comm.	Yes	Pipeline area	West of Port Jefferson	Lobster + finfish	Bluefish, striped bass, fluke, porgies, bluefish, whatever is in Sound	Lobster traps, hook and line, nets	12 months			None		

Public

No.	Interview?	Industry	Impact?	Fishing Area		Species targeted		Gear	Fishing season		Annual Harvest	Main Concerns	Other comments	Contacts
				General	Specific	General	Finfish specifics		General	Specific				
18	Yes	Comm.	Yes	Terminal area	Trawl lanes run 8-10 miles East West off CT. Milford is western end.	Finfish	Fluke, porgies, lobster (keepers only), flounder, squid, blackfish	Trawl, 1 hr to 2 hr tows depending on season, species, and harvest limits	12 months	Fishes in project area mid-April to mid-May, late summer (Aug.), and Dec-Jan	Estimate of lbs impossible. Can easily pull $30,000 - $40,000 per year from the project area	Size of security zone around LNG terminal. If 3-4 miles of trawl lanes are removed, significant amount since there are only 2 and they are only 8-10 miles long	Explained trawl lanes. 2 lanes off of CT, 8-12 mi long, 1/4 mi wide. Only place to trawl, no obstructions, no traps.West end is Milford, CT/72 longitude line/1580.0 Loran line. Southern boundary of trawl lane is Loran line 43970.0. No scallop fishing in Sound.	
19	Yes	Comm.	No	West of project area	Eaton's Neck and West to Playland	Lobster		Lobster pots/traps						Yes
20	Declined													
21	Yes	Comm.	Yes	Pipeline area	Also licensed to fish near terminal, but doesn't now	Lobster + Finfish	Whatever is in Sound, porgies, striped bass, flounder, fluke, squid	Lobster traps, fish traps, nets	12 months			Floating terminal, what happens to fishermen who are excluded from their area		
22	Declined													
23	Yes	Comm.	No?	Pipeline area?	Northport and Norwalk/Bridgeport area	Lobster + bycatch	Blackfish, porgies, conch (bycatch)	Lobster traps/pots						
24	Yes	Comm. and rec. (party boat)	No (finfish)	Party boat is West of project area		Lobster (comm.) + finfish (rec.)	Fluke, blackfish, bluefish, striped bass (rec.)	Loster traps/pots, rod and reel for finfish	Party boat May - Dec.			Needs more information		
25	Said he would call us back, but didn't													
26	Declined													
27	Yes	Comm.	Yes	Pipeline area	Concentrates effort in area	Lobster		Lobster traps	12 months	Slow periods are Sept/Oct and Feb/March		How long will gear be disrupted during construction, what happens to people that are fishing in the area around platform	Not too many trawlers	
28	Yes	Comm.	No	West of project area	West of Iroquois pipeline	Lobster		Lobster traps	12 months			None		
29	Yes	Comm.	Yes	General project area	Concentrates effort in area	Lobster		Lobster traps	12 months			Many concerns		

Public

No.	Interview?	Industry	Impact?	Fishing Area		Species targeted		Gear	Fishing season		Annual Harvest	Main Concerns	Other comments	Contacts
				General	Specific	General	Finfish specifics		General	Specific				
30	Yes	Comm.	Yes	General project area	Part of area where concentrates effort	Lobster + bycatch and conch	Blackfish, black sea bass (bycatch)	Lobster traps, conch pots	12 months	Leave gear in year-round, fishes winter if mild, peak early April to Aug, slows down until Oct.	Declined. But when it was good, it was really good. Starting to robuild. Difficult to estimate. Over $1 million/year.	Doesn't know enough about it. People on Sound want to know more about potential hazards.	Draggers have lane 70 and 73 lines, show up occasionally	Yes
31	Yes	Comm.	Yes	Terminal area	Depending on size of buffer zone, may be impacted	Lobster + bycatch	Flounder, squid, fluke (bycatch)		Spring and Summer			Terminal and pipeline will be situated in the prime location for lobster in LI Sound. They need more info. about project, including potential problems		Yes
32	Yes	Comm.	No	Nearshore CT waters		Shellfish		Bottom culture	12 months	Marketing peaks are summer and holidays		Project is mostly in NY waters. Will think about it.	Probably too deep for bottom culture, suspended long lines could occur in deep water. No scallop fishing that he knows of, bay scallops only in shallow water.	Yes
33	Called 3x, 2 messages, no contact													
34	Yes	Comm.	Yes	Pipeline area	Fishes off Port Jefferson, 7 mile stretch in pipeline area, Not near terminal	Lobster + bycatch	Blackfish (bycatch)	Lobster traps	12 months	February is only month off		If they put the pipeline down what will they do about people who have to move their gear, timing of construction, burial will stir up bottom	Not too many trawlers	
35	Called 4x, 2 messages, no contact													
36	Yes	Rec., Party Boat	Yes	Terminal area	Fishes sunken wrecks in area of proposed terminal	Finfish	Blackfish, bluefish, striped bass, porgies, sea bass	Rod and reel	April through Dec.	Fishes in area of proposed terminal during April and May and Sept - Dec.	30 passengers per trip, a few thousand a year	Greatest concern is closing of area around terminal and permanent exclusion from area. Curious about special permits		Yes
37	Declined													
38	No	Rec, boater	No	Does not fish in the Sound										Yes

Public

No.	Interview?	Industry	Impact?	Fishing Area		Species targeted		Gear	Fishing season		Annual Harvest	Main Concerns	Other comments	Contacts
				General	Specific	General	Finfish specifics		General	Specific				
39	Left message, no response													
40	Yes	Rec., Party boats (3)	Yes	Terminal	Off of Roanoke shoals and Wading River	Finfish	Flounder, striped bass, fluke, porgies, sea bass, blackfish	Rod and reel	April to mid-Dec.		Carries up to 300 people per day on wkends and 60-100 people per day on wkdays	Environmental impacts, potential for accidents, degradation of Sound.		Yes
41	Yes	Rec., Party boats (2)	Yes	Terminal and pipeline		Finfish	All fish in season, bottom fish and bluefish	Rod and reel	April through Dec.		Carrries approx. 40 people per day on 2 boats	Exclusion zone will take away fishing areas. Concerned about anchoring over pipeline, one more piece of bottom that can't be used. Potential for accidents.		
42	Yes	Comm.	No	East of project area		Finfish	All fish in season	Trawl	Part-time			Exclusion zone will affect other fishermen. Tankers will have to come through race area, narrow and heavy traffic. Stong waves in Sound, terminal won't stay attached to mooring.		
43	Left message, no response													
44	Left message, no response													

Public

APPENDIX D

VISUAL RESOURCE ASSESSMENT

SARATOGA ASSOCIATES

BROADWATER

BW002039

Broadwater Energy LLC, (Broadwater) is filing an application with the Federal Energy Regulatory Commission (FERC) to construct and operate a marine liquefied natural gas (LNG) terminal and interconnected submarine pipeline for the importation, storage, regasification, and transport of natural gas.

The proposed Broadwater LNG terminal will be located in Long Island Sound (the Sound), approximately nine (9) miles from the shore of Long Island in New York State waters. The proposed LNG terminal will consist of a floating storage and regasification unit (FSRU), that is approximately 1,215 feet (370 meters [m]) in length, 200 feet (61 m) in width, and rising approximately 80 feet (25 m) above the water line to the trunk deck. Several major structures are mounted on the FSRU hull including; emergency burn-off flare (279 feet [85 m] above water line), radar mast (177 feet [54 m]), cranes (up to 167 feet [51 m]), waste heat recovery unit (WHRU) (148 feet [45 m]), helideck (148 feet [45m]), living quarters (138 feet 42 m]), LNG offloading arms (138 feet [42 m]) and other deck mounted structures.

The FSRU will be moored in place using a yoke mooring system (YMS) that allows the FSRU to pivot around the mooring tower base. The YMS includes a fixed structure secured to the sea floor by four legs. The YMS rises 134feet [41 m] above the waterline.

The LNG will be delivered to the FSRU in LNG carriers with a net cargo capacity of 125,000 m^3 to 250,000 m^3 at the rate of two to three carriers per week.

A 30-inch-diameter subsea natural gas pipeline will deliver the vaporized natural gas to the existing IGTS. It will be installed beneath the seafloor from the FSRU mooring structure to an interconnection location at the existing 24-inch-diameter subsea section of the Iroquois Gas Transmission System (IGTS) pipeline, approximately 22 miles west of the proposed FSRU site.

This Visual Resource Assessment evaluates the potential visibility of the proposed project and objectively determines the difference in the visual characteristics of the water-based setting with and without the project in place. The process follows basic techniques of the New York State Department of Environmental Conservation Program Policy "Assessing and Mitigating Visual Impacts" (NYSDEC Visual Policy) in order to identify and mitigate impacts. This process has been designed so decision makers and the public can understand the potential visual impacts and make an informed judgment about their magnitude and aesthetic significance.

Based on a comprehensive alternatives evaluation process (refer to Resource Report 10), the Project has been sited near the center of the Sound at its widest point, in part, to maximize the distance from any coastal vantage point and minimize potential visual impact on coastal resources. The LNG terminal is approximately nine (9) miles off the Long Island coast and ten (10) miles off the coast of Connecticut (see Figure 1 – Proposed Broadwater Project Location in Long Island Sound on page 4).

There is no location within the Sound where the project would be substantially farther from the nearest coastal observer.

While the color of the FSRU/YMS structure has not been determined, there are options available. For example, shades of gray can be used to minimize contrast between the LNG terminal and the washed out distant blue – gray colors of the background as well as the foreground waters of the Sound. U.S. Coast Guard (USCG) or other requirements that have not yet been determined may also influence final color selection.

The outer limits of the evaluated study area extend to a distance of twenty-five miles from the proposed LNG terminal. This study radius was selected considering the following factors:

- Curvature of the Earth - For an observer standing approximately 40 feet above sea level at a distance of 25 miles from the facility, all portions of the FSRU below the Helideck (148 feet [45 m] above waterline) will be below the visible horizon. Similarly, for an observer standing at beach elevation, the helideck would disappear below the horizon at a distance of approximately 20 miles.
- Meteorological Visibility - The proposed LNG terminal will be completely obscured from all coastal vantage points by haze or fog at least 24 percent of the time based on local meteorological conditions.
- Sheer Distance - A broadside view of the FSRU at a distance of 25 miles would measure only 0.6 degrees horizontally on the horizon and 0.08 degrees vertically. At such extended distance, it is unlikely that this limited visibility would be considered a significant point of interest to the typical observer.

The vast majority of views of the proposed LNG terminal structures will be limited to immediate shoreline locations. In most locations project visibility is quickly screened from inland vantage points by dense coastal vegetation, topography and structures.

The north shore of Long Island includes nearly 55 miles of coastline within the 25-mile study radius. Of this, the proposed LNG terminal will be visible from approximately 44 miles of coastline (80%). The Connecticut side of the Sound within the 25-mile study radius includes nearly 92 miles of coastline. Of this, the proposed LNG terminal will be visible from approximately 46 miles (50%) of the shoreline. No coastal areas with approved NYS Local Waterfront Revitalization Plans (LWRPs) fall within the affected viewshed area.

Broadwater Energy, LLC has conducted a thorough inventory of all aesthetic resources meeting the NYSDEC definition of national and statewide significance, as well as those meeting a more conservative definition of resources of local interest within the 25-mile study radius. 228 locations meeting theses definitions were identified within the affected viewshed area. The vast majority of resources of statewide significance or local interest found along the Long Island and Connecticut coastlines are seasonal day-use public beaches and waterfront parks.

The Connecticut and Long Island coastal area includes numerous private residential properties (both permanent and second homes) that are clearly oriented to take advantage of scenic Sound views. These properties are found at beach level and on surrounding hillsides with unimpeded views towards the Sound. Because of these views, these homes are almost always of very high real estate value and are often cherished places for families who live or vacation there. The coastal area is also a popular seasonal tourist destination. Visitors to waterfront hotels and smaller bed and breakfast type establishments, open to the general public, choose to vacation along the Sound to enjoy the scenic, recreational, social, peaceful and cultural ambiance of the coastal landscape.

Affected viewers will most commonly be local residents enjoying Sound views from their homes or neighborhoods, and visitors enjoying passive or active recreational pursuits from coastal or on-water locations. While such viewer groups will likely be more sensitive to the presence of the proposed LNG terminal than other viewer groups, viewers who recognize and understand the Sound as a multi-purpose waterbody may be less affected by the presence of the proposed LNG terminal on the distant horizon.

The proposed LNG terminal will be the largest moored object on the Sound. However, with the nearest coastal vantage point approximately nine (9) miles distant, all shoreline receptors will view the proposed Project within the far background distance zone. At this distance, elements lose detail and become less distinct. Typically, atmospheric perspective (hazing) reduces colors to blue-grays, while surface characteristics (lines and textures) are lost. On clear days the FSRU/YMS and LNG vessel may be a point of visual interest for observers at the closest vantage points along both the New York and Connecticut coastlines. However, the proposed LNG terminal will decrease in visibility from distant receptors up and down the coast with increased distance over the horizon and the compounding effect of atmospheric perspective.

When visible, the proposed facility will generally appear as a small two-dimensional rectilinear form on the horizon from distant coastal vantage points. Although a relatively small element within the context of the Sound, the geometric form of the LNG terminal contrasts with the expansive planar form of the Sound and sky. While the outline of the Project will break the visible horizon, from distant coastal vantage points the Project will appear quite low and, as distance increases, increasingly difficult to distinguish from the horizon.

The proposed LNG terminal has been sited near the center of the Sound at its widest point, in part, to maximize the distance from any coastal vantage point and minimize potential visual impact on coastal resources. The LNG terminal will be approximately nine (9) miles from the nearest coastal vantage point. There is no location within the Sound where the project would be substantially farther from the nearest coastal observer. While the color of the FSRU/YMS structure has not been determined, there are options available. For example, shades of gray can be used to minimize contrast between the LNG terminal and the washed out distant blue – gray colors of the background as well as the foreground waters of the Sound. These factors combine to minimize visual distinction and perceived importance of the Project within the context of the regional landscape (waterscape). Importantly, any residual

impacts will not be permanent. As required by the DEC Visual Policy, at the end of its useful life the FSRU/YMS will be decommissioned by complete removal, restoring the Sound to its pre-Project visual condition.

The NYSDEC visual Policy states,

> " Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Significant aesthetic impacts are those that may cause a diminishment of the public enjoyment and appreciation of an inventoried resource, or one that impairs the character or quality of such a place. Proposed large facilities by themselves should not be a trigger for a declaration of significance. Instead, a project by virtue of its siting in visual proximity to an inventoried resource may lead staff to conclude that there may be a significant impact."

Based on this definition, it is reasonable to conclude that visibility of the proposed LNG terminal (albeit a large facility), does not result in a detrimental effect on the perceived beauty of any place or structure; nor will the project cause the diminishment of public enjoyment and appreciation of an inventoried resource, or impair the character or quality of such a place.

Broadwater Energy LLC is filing an application with the Federal Energy Regulatory Commission (FERC) seeking all of the necessary authorizations to construct and operate a marine liquefied natural gas (LNG) terminal and subsea connecting pipeline for the importation, storage, regasification, and transport of natural gas. The Broadwater LNG Project (the Project) will increase the availability of natural gas to the New York and Connecticut markets through an interconnection with the Iroquois Gas Transmission System (IGTS).

To address issues of potential visual impact Broadwater Energy, LLC has retained Saratoga Associates, Landscape Architects, Architects, Engineers, and Planners, P.C. (Saratoga) to conduct a thorough and detailed Visual Resource Assessment (VRA) of the proposed project. The purpose of this VRA is to identify potential visual and aesthetic impacts and to provide an objective assessment of the visual character of the project, using standard accepted methodologies of visual assessment, from which agency decision-makers can render a supportable determination of visual significance. The procedure employed recognizes that aesthetic values are based upon human perception, and therefore individuals may respond differently to the Project because of various social, cultural and educational backgrounds.

Consistent with Visual Resource Assessment (VRA) practice, this report evaluates the potential visibility of the proposed project and objectively determines the difference between the visual characteristics of the water-based setting with and without the project in place. The process follows basic techniques of the New York State Department of Environmental Conservation Program Policy "Assessing and Mitigating Visual Impacts" (NYSDEC Visual Policy) in order to identify and mitigate impacts. This process has been designed so decision makers and the public can understand the potential visual impacts and make an informed judgment about their magnitude and aesthetic significance.

This evaluation includes both quantitative (how much is seen and from what locations; or visual impact) and qualitative (how it will be perceived; aesthetic impact) aspects of visual assessment.

The visual impact assessment includes the following steps:

- Define the existing landscape (waterscape) character/visual setting to establish the baseline visual condition from which visual change is evaluated;
- Conduct a visibility analysis (viewshed mapping and field investigations) to define the geographic area surrounding the proposed facility from which portions of the project might be seen;
- Identify sensitive aesthetic resources to establish priority places from which further analysis of potential visual impact is conducted;
- Select key receptors from which detailed impact analysis is conducted;
- Depict the appearance of the facility upon completion of construction;

- Evaluate the aesthetic effects of the visual change (qualitative analysis) resulting from project construction, completion and operation, and;
- Identify opportunities for effective mitigation.

There are no specific Federal rules, regulations, or policies governing the evaluation of visual resources. However, the methodology employed herein is based on standards and procedures used by the U.S. Department of Agriculture (National Forest Service, 1974, 1995), U.S. Department of the Interior, Bureau of Land Management (USDOI, 1980), U.S. Department of Transportation, Federal Highway Administration (USDOT, 1981), NYS Department of Transportation (NYSDOT, 1988), and the NYS Department of Environmental Conservation (NYSDEC, July 31, 2000).

- The process used follows basic New York State Department of Environmental Conservation Program Policy "Assessing and Mitigating Visual Impacts" (NYSDEC 2000) (DEC Visual Policy) and State Environmental Quality Review (SEQRA) criteria to minimize impacts on visual resources. This process provides a practical guide so decision makers and the public can understand the potential visual impacts and make an informed judgment about their significance (aesthetic impact).

- The Sound Coastal Management Plan (CMP) was developed in accordance with the Waterfront Revitalization of Coastal Areas and Inland Waterways Act, Article 42 of the Executive Law, and the New York State Coastal Management Program. The Sound CMP views the coast from four perspectives: the developed coast, the natural coast, the public coast, and the working coast. Thirteen policies guide development along the coast. Policy #3 of the CMP addresses aesthetic resources within the coastal areas.

Broadwater is in the process of preparing a Coastal Zone Consistency Determination for New York State that will include an evaluation of the compatibility of the proposed LNG Terminal with Coastal Policies.

The siting of the facility in its current location was based on a comprehensive and iterative process that evaluated potential terminal design concepts and sites throughout the entire Long Island Sound region, including both onshore and offshore locations. This site selection process included assessment of a wide range of environmental and socioeconomic considerations as well as a number of technical engineering criteria (See Resource Report 10 for a full discussion of the siting and alternatives evaluation process). With respect to socioeconomic considerations, a critical siting criterion was to maximize the distance of the terminal from shore, which among other considerations, influences visual impacts on populated areas. The LNG terminal is proposed to be located near the center of the Sound at its widest point; nine (9) miles off the Long Island coast and ten (10) miles off the coast of

Connecticut (see Figure 1 – Proposed Broadwater Project Location in Long Island Sound on page 4). There is no location within the Sound where the project would be substantially farther from the nearest coastal observer.

The project is designed to receive, store, and regasify LNG at an average throughput of 1.0 billion cubic feet per day (bcfd) and will be capable of delivering a peak throughput of 1.25 bcfd. The Project will deliver the regasified LNG to the existing onshore natural gas pipeline system via a subsea interconnection to the IGTS pipeline. Following installation of the Project, only the FSRU and the YMS will be above the waterline. No permanent visual impacts will be associated with the pipeline. As such this VRA does not address this interconnect.

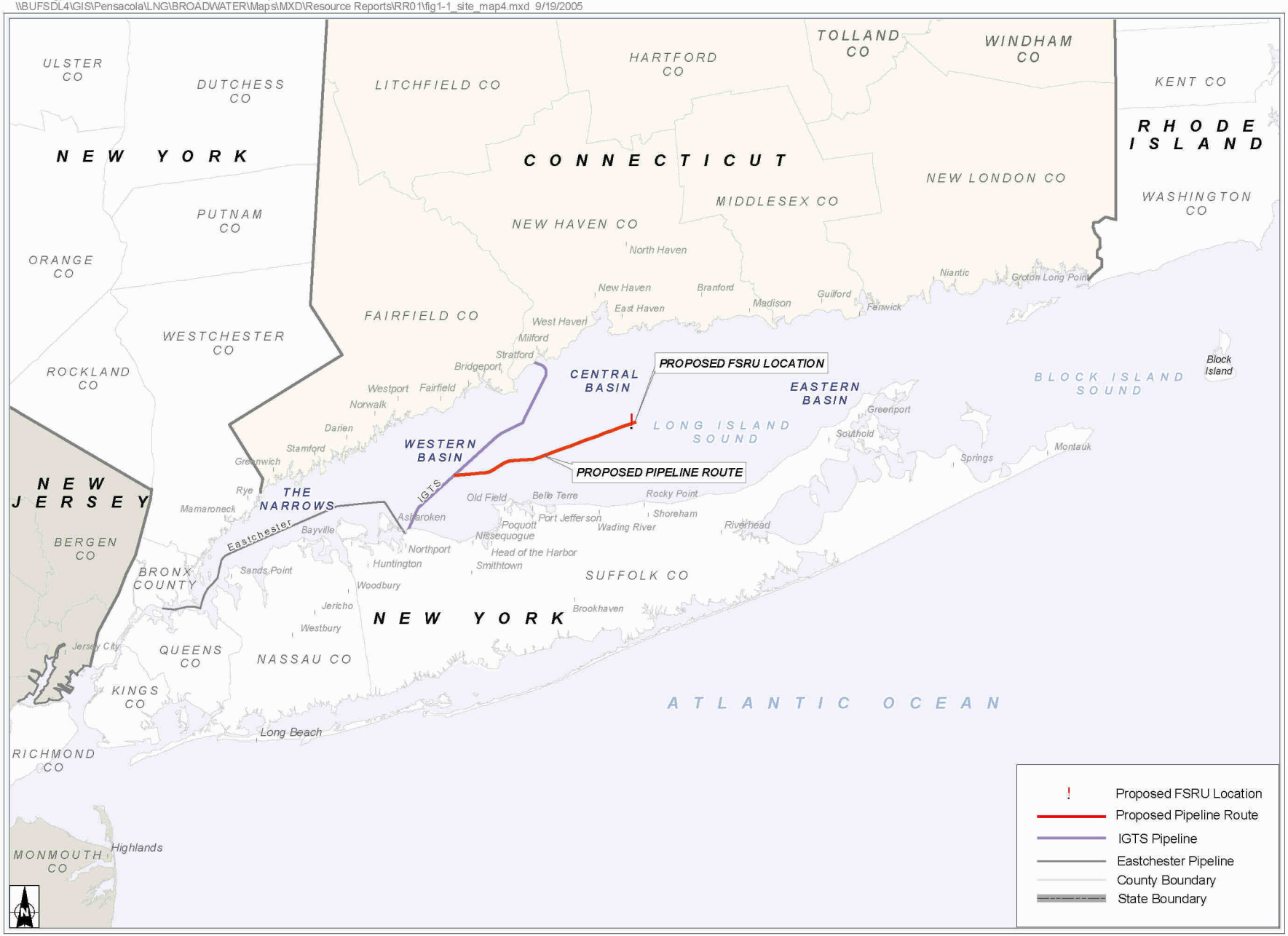
Visible components of the Project will consist of a floating storage and regasification unit (FSRU), that is approximately 1,250 feet (381 m) in length, 200 feet (61 m) in width, and rising approximately 80 to 102 feet (24 to 31 m) above the water line to the deck. The FSRU will be designed to accommodate storage of approximately 8 billion cubic feet (bcf) (350,000 cubic meters [m^3]) of LNG, with vaporization capabilities of 1.0 bcfd. Several major structures are mounted on the FSRU hull. These include the following:

The emergency burn-off flare is a safety feature that would only be ignited during unanticipated and very rare emergency events. No consequential visual impact is associated with such fleeting and out of the ordinary events. Accordingly, it is not evaluated in this VRA.

The FSRU will be moored in place using a yoke mooring system (YMS) that allows the FSRU to pivot around the mooring tower base. The YMS includes a fixed open frame structure secured to the sea floor by multiple legs. The YMS will have a footprint of approximately 13,180 square feet (1,225 square meters [m^2]) and houses the connection between the FSRU and the proposed subsea delivery pipeline. The YMS rises 134 feet (41 m) above the waterline. While the color of the FSRU/YMS structure has not been determined, there are options available. For example, as stated previously, the use of shades of gray are under consideration to minimize contrast between the LNG terminal with washed out distant blue – gray colors. . Final color selection may also be influenced by U.S. Coast Guard requirements that have not yet been determined.

Because the Project includes a helideck (for emergency transport only), the emergency burn-off flare tower will be painted with alternating bands of aviation orange and white.

Figure 2 identifies the primary components of the FSRU and YMS. Figure 3 - Wind Rose for 10-Year Hindcast illustrates the frequency and direction of FSRU pivot orientation.



Source: ESRI StreetMap, 2002.

0 5 10 20 30
Miles

Figure 1 - **Proposed Broadwater Project Location in Long Island Sound**

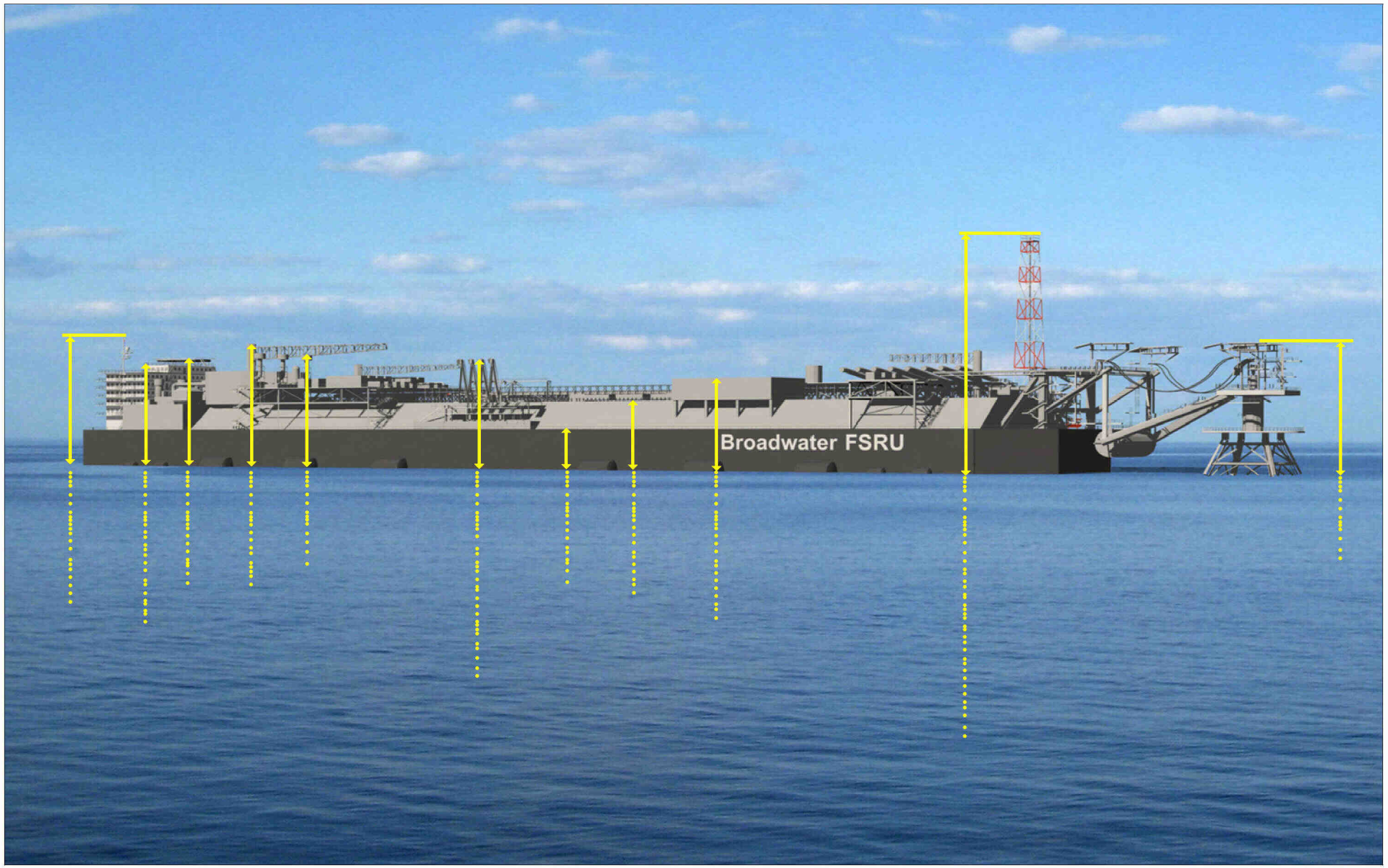


Figure 2
FSRU/YMS Primary Components

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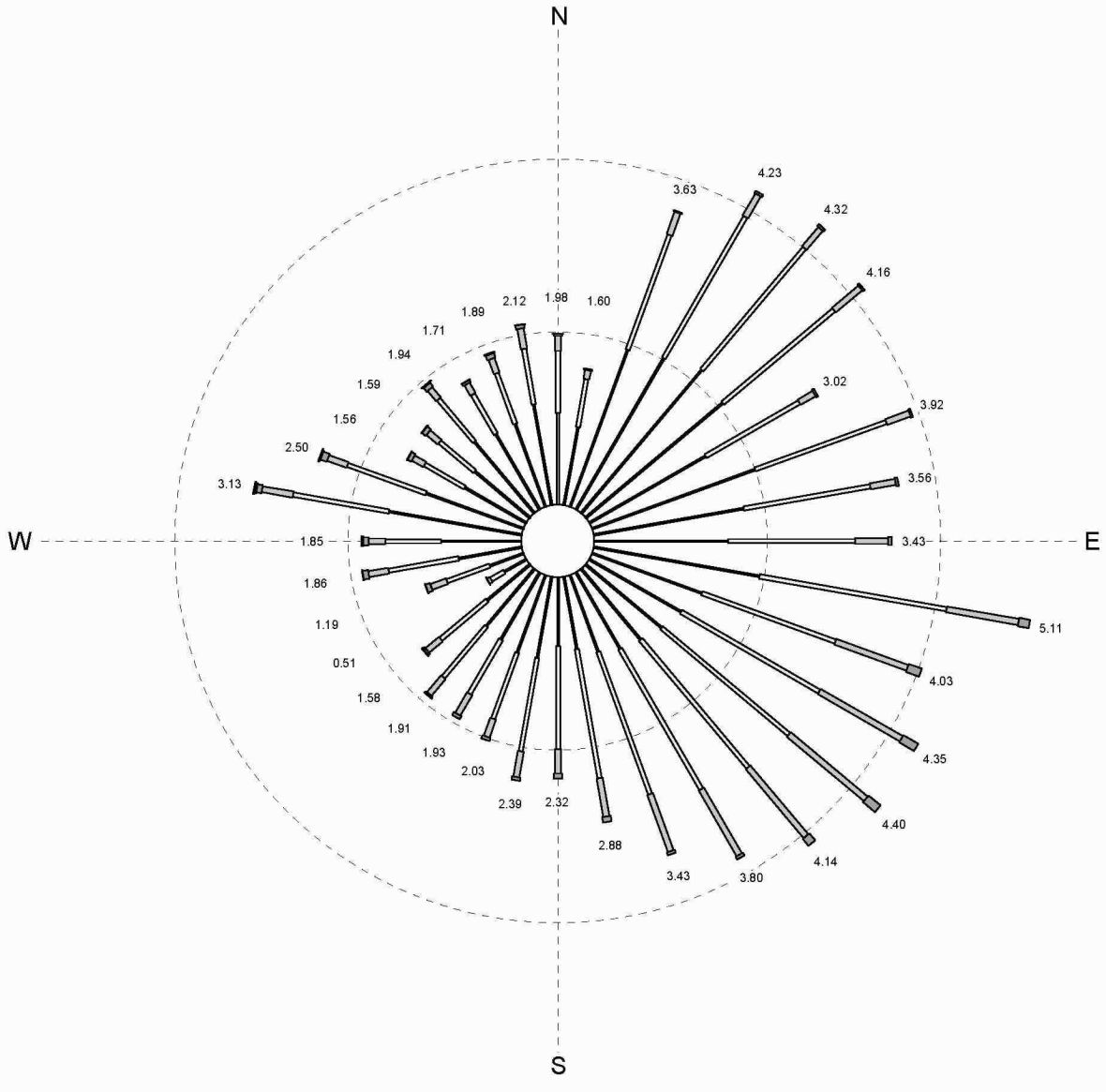
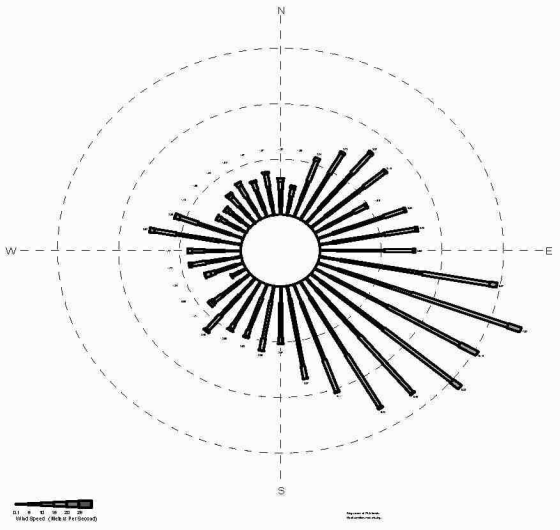
Wind Speed at FSRU Site
(Directions are TOWARDS)

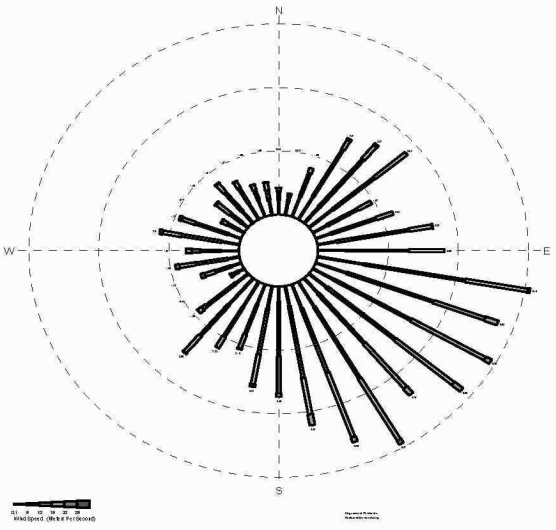


Rings drawn at 2% intervals.
No observations were missing.

January



February



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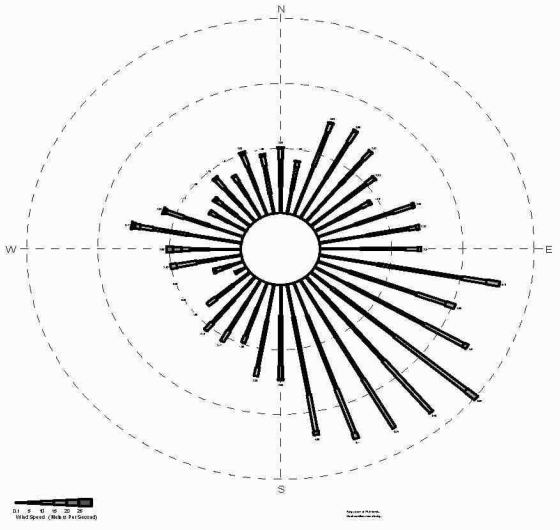

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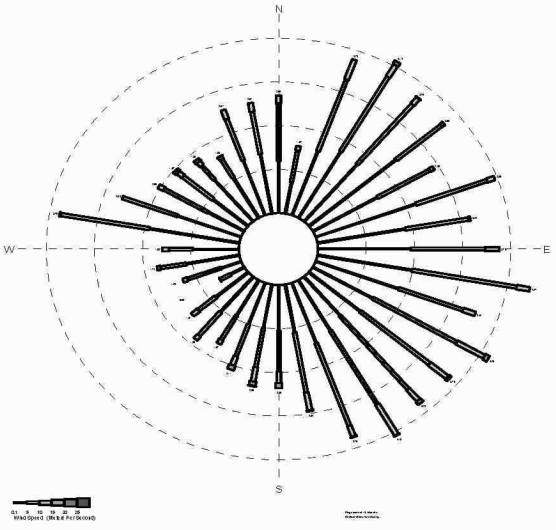

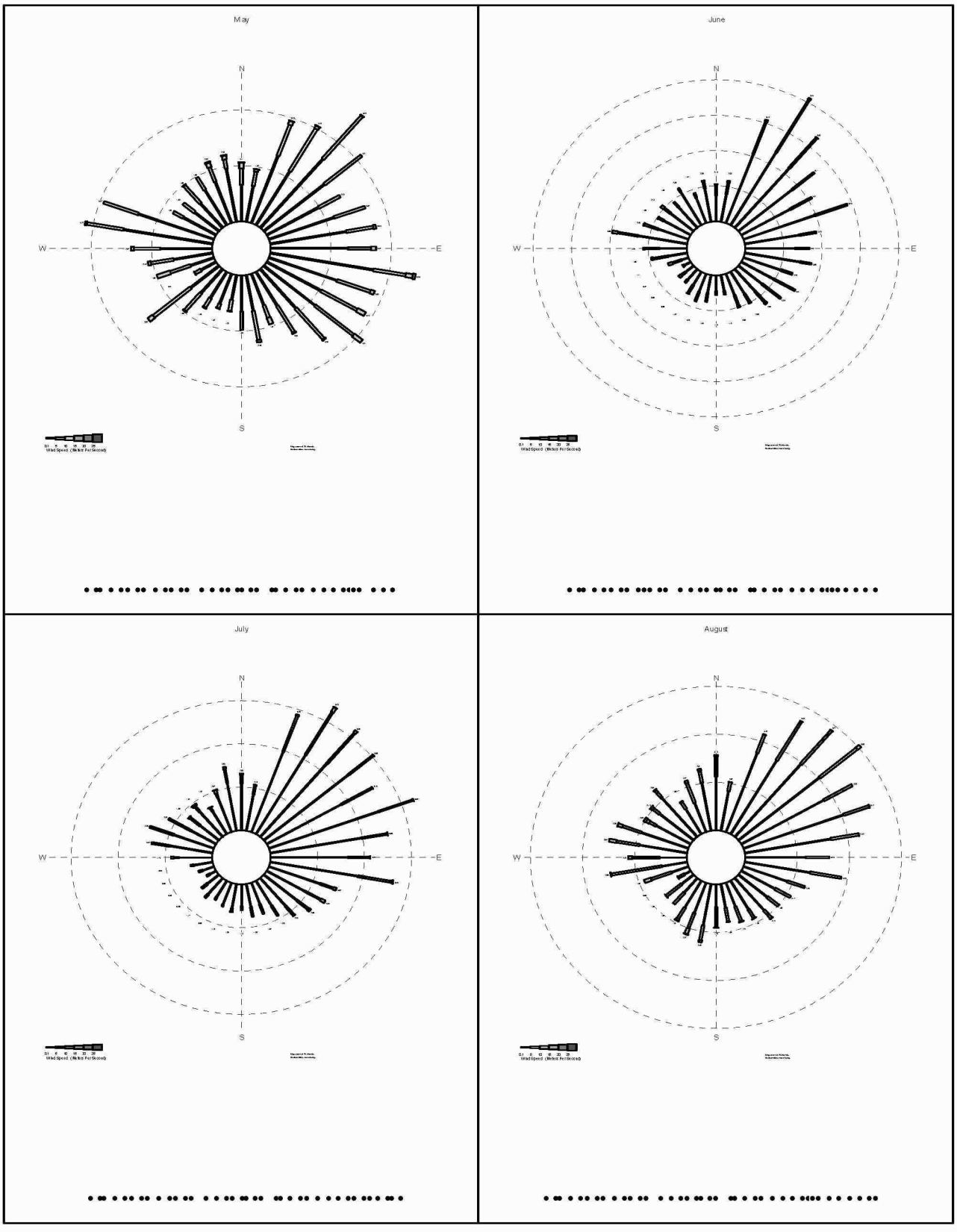
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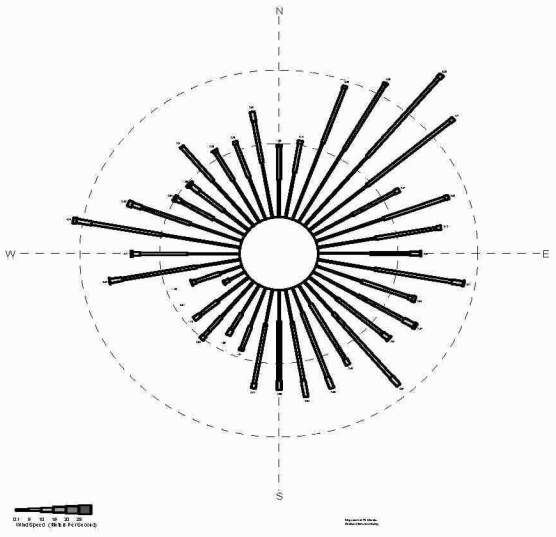
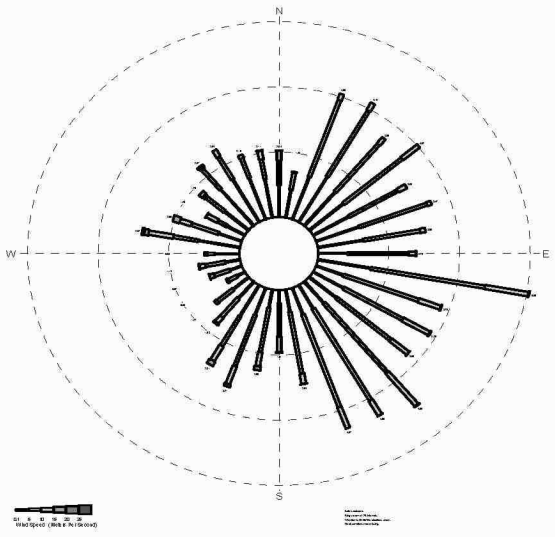
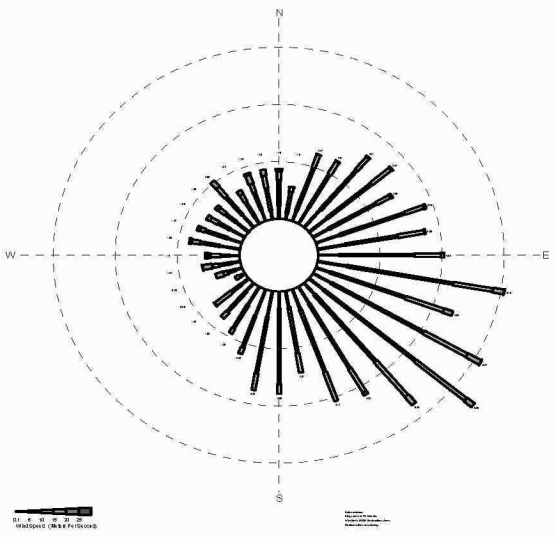


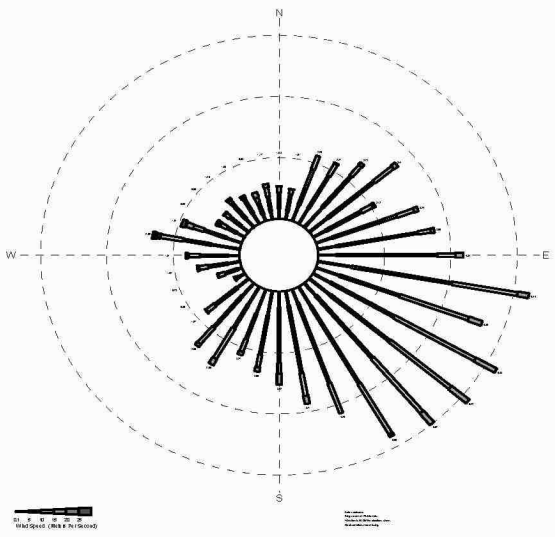
October



November



December



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[illegible] - In substantial and complex projects, detailed engineering typically does not occur until the regulatory process nears completion and final design parameters are established. Detailed lighting plans for the Project fit into this category. Consequently, Broadwater will develop a final lighting plan during the detailed design phase of the project.

The preliminary lighting concept for the Project requires the FSRU deck and YMS be illuminated during the hour of darkness for safety and operational purposes, irrespective of the presence of an LNG carrier. For safety and security purposes, over-side lighting will be needed around the perimeter of FSRU and YMS. Preliminary lighting levels for exterior areas are summarized in Table 2.

[illegible]

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
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[illegible] - The U.S. Department of Transportation Federal Aviation Administration (FAA) Advisory Circular - AC70/7460-1K provides advisory recommendations for obstruction marking and lighting. Using these recommendations as a guideline, the FAA Regional Air Traffic Division will conduct an aeronautical study to more specifically identify obstruction marking and lighting requirements.

According to FAA Advisory Circular AC70/7460-1K. Structures that exceed an overall height of 200 feet (61m) above ground level should normally be marked and/or lighted. The emergency burn-off flare (279 feet [85 m]) is the only structure exceeding this height. It is likely that the FAA will require this structure to be illuminated with red flashing aviation obstruction lights (L-864, 20-40 flashes per minute) mounted at the top and mid-point of the tower.

Because the Project includes a helideck (for emergency transport only), one (1) red flashing aviation obstruction light (L-864) will also be mounted on the radar mast (177 ft [54 m]).

[illegible] - A navigation aids system will operate in accordance with International Association of Lighthouse Authorities (IALA) "Recommendations for the marking of offshore

structures." The main warning lights for navigation obstruction will be located in fore and aft positions of the FSRU. Lights will be white colored, flashing Morse U at 30 second intervals and visible for 10 nautical miles from points 5m above sea level. Subsidiary warning lights, to be located along the port and starboard sides of the FSRU, will be red colored and visible for 2 nautical miles from points 5m above sea level.

- One (1) complete set of helicopter lights and illuminated windsock will be installed in accordance with FAA requirements for day and night operations.

The helideck lighting system will include approximately 20 helideck perimeter lights, approximately eight (8) floodlights illuminating the landing surface, a surface mounted (recessed) helideck main status light, and an illuminated wind sock. Because the helideck will be used for emergency transport only, these lights would only be turned on during takeoffs and landings.

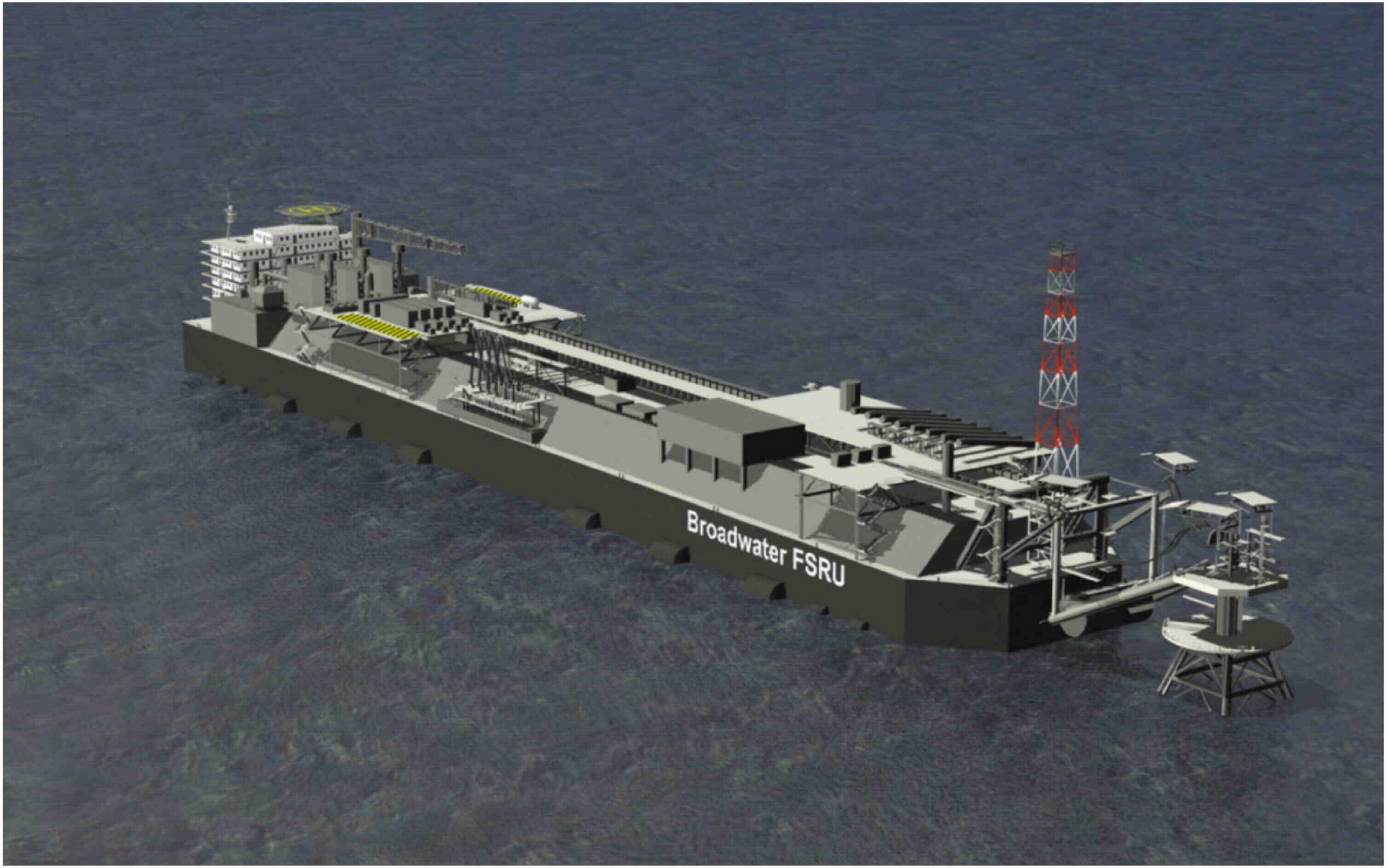
Broadwater has thoroughly evaluated combustion processes and determined that operation of the FSRU will not generate a visible vapor plume.

LNG will be delivered to the FSRU in ocean-going vessels with a net cargo capacity of 125,000 m3 to 250,000 m^3 at the rate of two to three carriers per week. LNG carriers will vary in size depending on vessel capacity. However, these vessels will be similar in visual character to other large ocean-going freighters that commonly transit the Sound.

The proposed delivery pipeline will be a 30-inch-diameter subsea natural gas pipeline to provide adequate delivery capacity for the vaporized natural gas. The pipeline will be installed beneath the seafloor from the FSRU mooring structure to an interconnection at the existing 24-inch IGTS subsea pipeline, approximately 22 miles (35 km) west of the proposed FSRU site.

No permanent visual impact associated with the subsea delivery pipeline is expected. For this reason potential effect of the interconnect on visual resources is not addressed.

Figure 4 depicts the general character of the FSRU and YMS structures, and the LNG Carrier.



FSRU/YMS

Figure 4A
Aerial View 1

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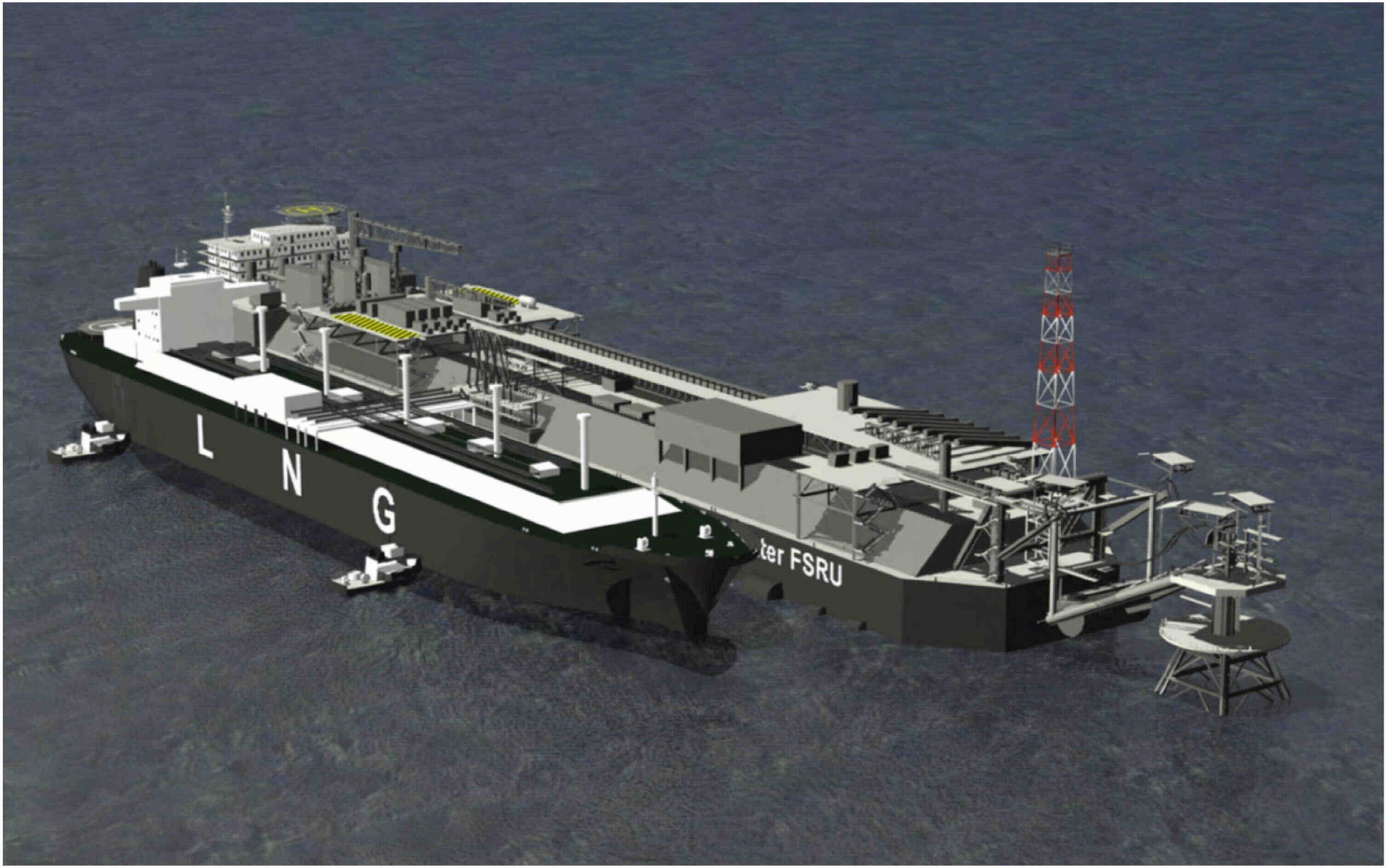

FSRU/YMS and LNG Carrier

Figure 4B
Aerial View 1

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FSRU/YMS—Night Condition

Figure 4C
Aerial View 1 - Front View

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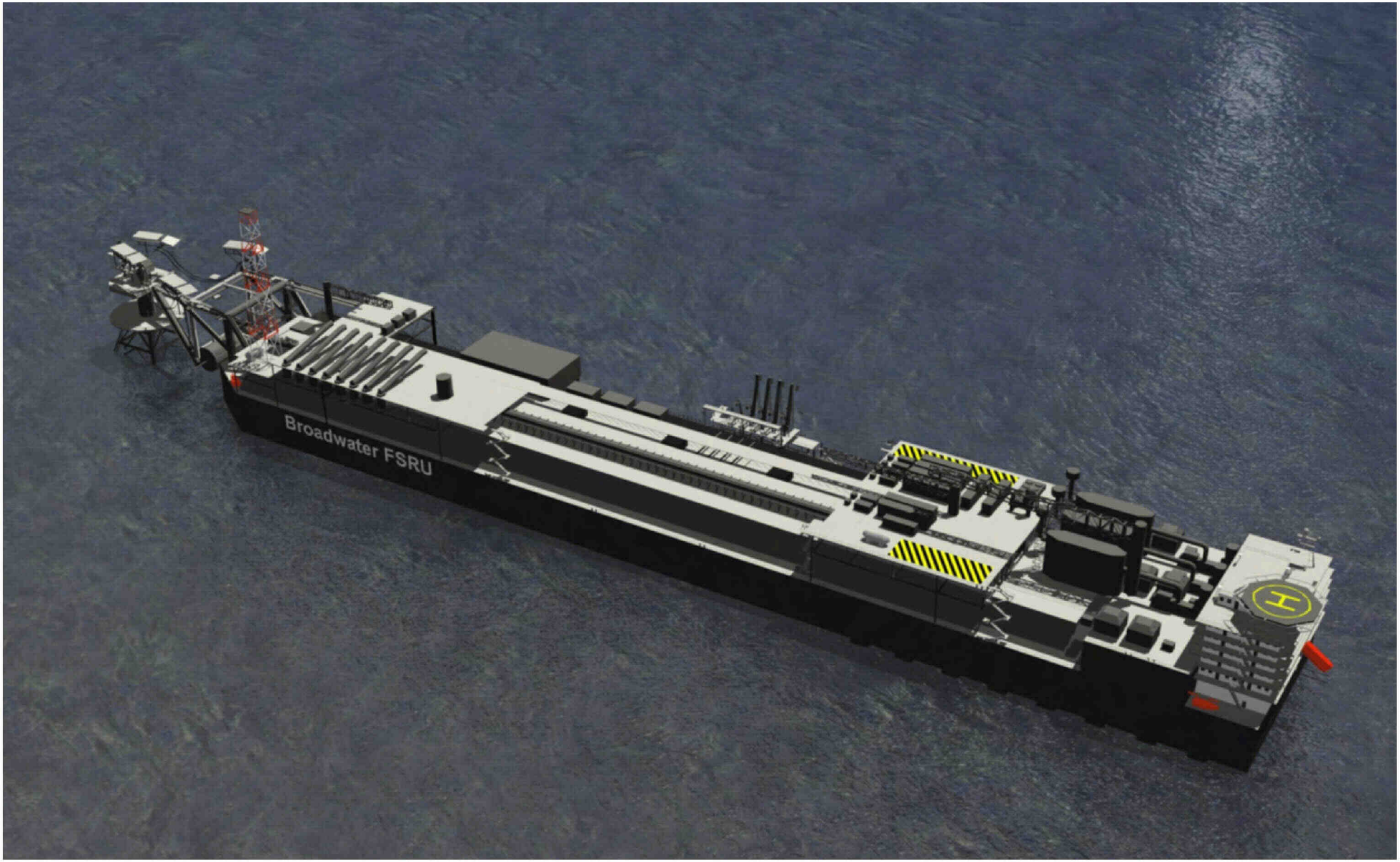
BROADWATER

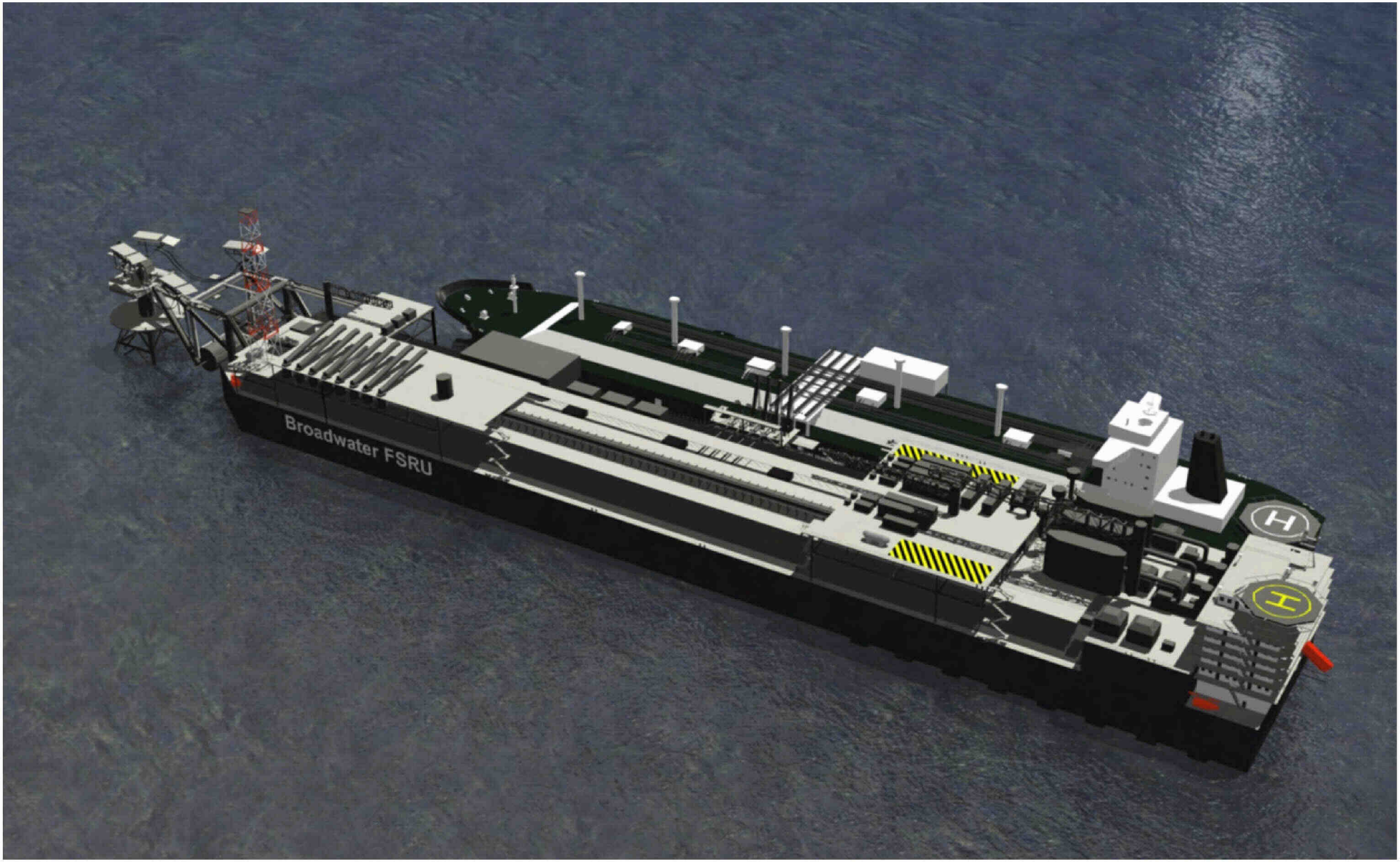


FSRU/YMS

Figure 4D
Aerial View 2

SARATOGA ASSOCIATES

BROADWATER



FSRU/YMS and LNG Carrier

Figure 4E
Aerial View 2

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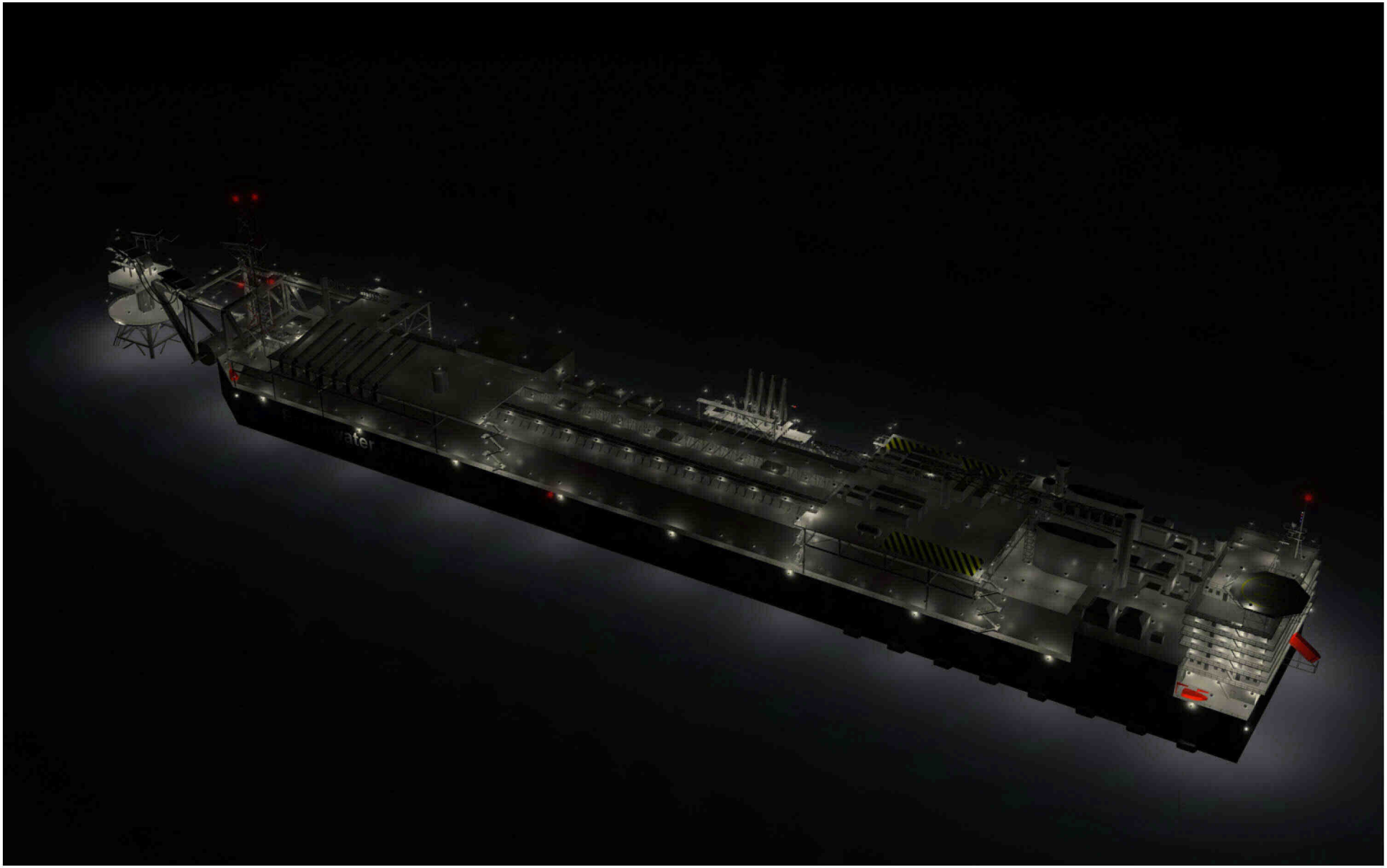
BROADWATER



FSRU/YMS—Night Condition

Figure 4F
Aerial View 2

SARATOGA ASSOCIATES

BROADWATER

Because there is no regulatory standard that defines the outer limits of a suitable study zone for this kind of proposal, the reach of this analysis extends along the coastal area to a radius of 25 miles from the proposed Project. This highly conservative study zone extends well beyond the 5-mile background distance normally considered the outer limit for most visual impact studies and exceeds virtually all case histories in New York State.

Twenty-five miles was selected as a reasonable limit to the primary visual assessment study area considering three predominant factors affecting project visibility; the affect of the curvature of the earth, the effect of atmospheric conditions, and sheer distance.

– For an observer standing approximately 40 feet above sea level at a distance of 25 miles from the facility, all portions of the FSRU below the Helideck (148 feet [45 m] above waterline) will be below the visible horizon. Similarly, for an observer standing at beach elevation, only the upper portion of the emergency burn-off flare structure (279 feet [85 m]) would extend above the horizon at a distance of 25 miles. A more detailed discussion of the effect of the curvature of the earth is found in Section 3.1 on page 26.

–Visibility is limited to nine (9) miles or less 24 percent of all daylight hours on an annual basis. More simply stated, the proposed LNG terminal will be completely obscured from coastal vantage points by haze or fog nearly ¼ of the time or more. A more detailed discussion of the effect of meteorological conditions is found in Section 3.3 on page 29.

– Exclusive of the effect of earth curvature and meteorological conditions, a broadside view of the FSRU at a distance of 25 miles would measure only 0.6 degrees horizontally on the horizon and 0.08 degrees vertically. While this very small degree of visibility would be perceptible to a distant observer, it is unlikely to be considered a point of interest at such extended distance.

Viewshed analysis indicates that the vast majority of views of the proposed LNG terminal will be limited to immediate shoreline locations (refer to Section 4.1.2 on page 36 below). In most circumstances project visibility is quickly screened from inland vantage points by dense coastal vegetation, topography and structures. Few publicly accessible vantage points with views of the Sound were found more than several hundred yards inland along both the Long Island and Connecticut coastline. For this reason, the study area is generally limited to ½ mile from the coastline within the 25-mile study radius.

However, recognizing that discrete views may occur from specific vantage points located at higher elevations, additional consideration was given to resources of high cultural or scenic importance that might be located further than ½ mile inland. These include potential views from Sleeping Giant State Park in Hamden, Ct, West Rock Ridge State Park in New Haven, Ct, and the Bluff Head trails in Guilford, Ct.

The visual setting is defined by the basic pattern of landform, land use, vegetation, and in this application especially, water features that make up a view. This visual setting, or existing landscape character is the baseline condition from which visual change can be evaluated.

Long Island Sound separates the State of Connecticut from the State of New York. The Sound is approximately 112 miles [180 km]) long between the Throgs Neck Bridge in Queens and Montauk Point. The Sound varies in width from relatively narrow as it nears New York City to approximately 21 miles between Wading River, New York and New Haven Connecticut; at the Project location.

The Long Island Sound was designated an Estuary of National Significance by the U.S. Department of Environmental Protection (U.S. EPA) in 1987 under its National Estuary Program. The designation focuses on improving water quality and maintaining the integrity of the whole system; its chemical, physical, and biological properties, as well as its economic, recreational, and aesthetic values.

Long Island Sound is home to many types of users, both commercial and recreational in nature. The waters of the Sound contain buoys, lighthouses, maritime commercial and industrial activities, a variety of boats and ships including freighters, ferries, and pleasure craft.

Commercial mainly involves vessels arriving at and departing from the ports of Northport and Asharoken, New York, and Bridgeport and New Haven, Connecticut. Port Jefferson is also a significant port, but it cannot accommodate deeper draft vessels. The main shipping route runs generally down the center of the Sound on a straight course from deepwater areas in the eastern Sound to the deepwater pass through Stratford Shoal, with a secondary shipping lane trending from northeast to southwest toward Northport. Table 3 presents 2003 commercial vessel traffic counts for deepwater ports in the Sound.

Refer to Resource Report 8 – Land Use, Section 8.3.7.1 for a more detailed description of commercial shipping in the study area.

The commercial fishing industry, which involves all portions of Long Island Sound, provides many jobs and contributes millions of dollars to the economies of both New York and Connecticut. Commercial and recreational fishing activities are discussed in detail in Resource Report 8.

The Long Island Sound is the dominant recreational and economic resource in the region. According Long Island Sound Study, the Sound contributes an estimated $5.5 billion annually to the regional economy from boating, commercial and sport fishing, swimming, and sightseeing[1].

On-water recreational uses include power boating and sailing, and recreational fishing. According to the Long Island Sound Study, 200,000 boats are registered "Sound-wide" and there are 20,000 boat slips on the Sound. There are also 750,000 recreational fisherman, with the sport fishery worth an estimated $70-$130 million to the economy in 1987[2]. A boat traffic survey commissioned by Broadwater to quantify boat use in the area of the proposed project concludes the number of vessels passing within three (3) miles of the proposed LNG terminal is expected to be very limited considering smaller watercraft typically navigate relatively close to shore.

Sailing regattas are also common with annual events including the Block Island Race, Stratford Shoal Race, Around Long Island Regatta, Vineyard Race, and many other smaller local races.

Two year-round ferry services operate in Long Island Sound, one from Port Jefferson, New York, to Bridgeport, Connecticut, and one from Orient Point, New York, to New London, Connecticut. A number of touring companies offer sightseeing tours throughout Long Island. Tours mainly are given in near-shore areas and do not generally traverse the central portion of the Sound.

Refer to Resource Report 8 and its Appendix containing the Boat Traffic Survey for a more detailed description of on-water recreation in the study area.

From all vantage points the Project will be viewed over open water. In general, the waters of the Sound appear dark bluish-gray typical of northeastern U.S. oceanic water (as compared to the light greenish blue colors common to southeastern U.S. waters). Cloud cover, wind sun reflectance and surface glare affect the color of the water and often create patterns of color variation over the water surface. The visible texture of the water is affected by the action of waves. These factors contribute to an amalgam of shimmering colors and patterns of light that are of aesthetic interest and may command the attention of observers.

On clear days, views across the Sound to the opposite coastline are common. At distances of 20 miles or more (in the Project area) such distant views are generally subtle without details of distinct features. The distant coastline appears as a muted horizontal line very low on the distant horizon. Depending on atmospheric conditions, the opposite shore appears as a bluish-gray band, often difficult to discern. The unique topographic form known as the Sleeping Giant (elevation 750 feet), approximately five (5) miles inland, north of New Haven, is a commonly recognized landform along the Connecticut coast. While the distant coastline of Connecticut is commonly visible from Long Island, the coastline of Long Island is less obvious from the Connecticut shore due to lower coastal elevations.

[1] http://www.longislandsoundstudy.net/pubs/facts/eLIS01.pdf
[2] http://pclt.cis.yale.edu/ynhti/curriculum/units/1997/6/97.06.08.x.html#b

From certain locations on very clear days, shoreline observers on Long Island may be able to observe the subtle geometric outline of high-rise buildings in New Haven and Bridgeport Connecticut. These tall urban structures offer little variation from the monochromatic blue/gray context, and are discernable only to the most observant viewers.

The waterfront along much of the Long Island coast in Suffolk County is characterized by extended stretches of sand and/or pebble beaches generally ranging in width from 20-40 feet to 150-200 feet depending on location and tide. Extensive stretches of beach have remained undeveloped due to steep and very proximate bluffs

Municipality/District	Approximate Bluff heights
Town of Southold	
Inlet Pt.	40-50ft
Horton Point	70-80ft
Goldsmith Inlet	40-50
Oregon Hills	90-120ft
Mattituck Hills	110-150ft
Town of Riverhead	
Jacobs Pt.	130-160ft
Roanoke Ldg.	130-180ft
Baiting Hollow	150-190ft
Wildwood St. Pk.	90-160ft
Wading River	100-150ft
Shoreham	120-140
Town of Brookhaven	
Rocky Point	110-140ft
Sound Beach	80-120ft
Miller Place	70-130ft
Belle Terre	100-120ft
Old Field	50-80ft

The bluffs range in height from 10-20 feet above sea level to over 150 feet in some locations. They are typically vegetated with dense coastal shrub and tree species. However, steeper portions often include erosion scars and open sandy patches that are visually distinctive by virtue of their sharp color contrast with adjacent dark vegetation.

Some bluffs are undeveloped in their entirety and/or preserved for conservation or recreational uses, however, residential development is common along the top surface and even some side slopes. From the bluff top, dense coastal vegetation generally limits or obstructs views of the Sound. However, excellent views are provided from limited locations where coastal vegetation has been selectively cleared.

Just inland of the bluffs, as one travels from the east towards the west, old Long Island begins to blend with newer developments that characterize an ever-expanding Metropolitan New York Region. The older and still largely intact eastern villages and hamlets of the North Fork, including Greenport and Mattituck, along with rural homes, potato and sod farms and vineyards in Peconic, Jamesport and Baiting Hollow continue to dictate the scenic and quaint landscape character of eastern Long Island. The North Fork of Long Island is generally less than three miles wide; separating the Sound and Peconic Bay. Parallel Routes 25 and 48 (Sound Avenue) provide the primary east-west access between Riverhead and rural Orient Point; the eastern most point on the North Fork. In these rural areas, many north-south local roads simply end at beachfront locations; often with public access to the Sound.

The further one travels west towards Wading River, Shoreham, Port Jefferson, Smithtown and beyond, suburban land uses along the coast become more pronounced as low density rural residential uses, agriculture and open space give way to recent suburban residential and commercial development. Heavy traffic, moderately dense residential subdivisions and commercial strips are common.

Visitors to eastern Long Island may arrive by ferry at Port Jefferson from Bridgeport or Orient Point from New London, but most travel along major inland arterials such as the Long Island Expressway

(I-495) or the NYS Route 25 and 25A commercial corridors. From these major roads visitors and residents cross towards the northern shore using any number of local north-south roads.

Although most marinas are located on the south side of the North Fork in Peconic Bay, inlets and small harbors sheltering recreational and commercial fishing vessels from the open water of the Sound are found in Mattituck in the Town of Southold, Cedar Beach in the Town of Brookhaven and Head-of-the-Harbor in the Town of Smithtown. The quaint and historic seaside community of Port Jefferson includes the largest harbor within the study area serving a relatively large fleet of recreational and shallow draft commercial vessels.

Numerous public parks, beaches and designated open spaces are found within the coastal area along Long Island's North Shore. With attendant asphalt parking and a substantial automobile presence during clement weather they are an important visual component of the region. High season access is limited at many beaches and parks to local residents. However, Wildwood State Park in the Town of Brookhaven and Sunken Meadow State Park in the Town of Smithtown provide multiple passive and active recreational facilities for residents and visitors alike.

The coastal area of Long Island's North Shore includes several large and visually prominent industrial facilities. The 1,500-megawatt Northport Power Station (just west of the 25-mile radius study area), the 350-megawatt Port Jefferson Power Station and the Shoreham Energy Center (decommissioned Shoreham Nuclear Power Station) are large industrial complexes. These facilities are highly visible from beachfront locations on Long Island, distant water views from the Sound, as well as coastal vantage points in Connecticut.

ConocoPhillips operates a visually prominent offshore petroleum-unloading terminal approximately two-miles off the coast in the Town of Riverhead near Iron Pier Town Beach. Several large associated petroleum storage tanks are located on top of the 160-foot high bluffs near the terminal.

The Connecticut coast in Fairfield, New Haven and Middlesex Counties is notably different in character than the north shore of Long Island. The Connecticut coastline is more convoluted in form, with twists and turns forming concaved bays, coves and inlets. Irregular peninsulas of varying size protrude into the Sound and various rivers and steams cut inland. The geomorphology of the coastline alternates in a seemingly random jumble of granite rocks, ledges, and outcroppings and extended linear stretches of sand beach and large pockets low tidal marshland. The many bays and small harbors tend to have relatively confined views and are markedly different from the wider and more expansive panoramic views typical of the Long Island shore.

The Connecticut Coast is part of the Coastal Lowlands Region of New England. This zone is a low coastal area ranging from 6 to 16 miles wide. Topography typically ranges from 30 to 150 feet above sea level in a series of shallow hills and valleys. The lack of confining beachfront bluffs has allowed extensive waterfront development throughout the coastal area. The coastal area is generally heavily wooded except in areas of dense residential and commercial development.

This topological configuration allows for calm bays and; therefore, more commercial and recreational docking facilities and mooring areas than the portion of the study area in Long Island. Marinas and mooring areas are typically located within enclosed bays or upriver of the Sound in locations without direct line of sight views to the open water of the Sound. Coastal housing typically faces the water, but in Connecticut this frequently means orientation is towards the bay or inlet rather than the Sound itself.

Inland from the coast, topography rises abruptly from the lowlands to elevations exceeding 500 feet. A unique topographic form known as the Sleeping Giant (elevation 750 feet), approximately five (5) miles inland, north of New Haven, is a commonly recognized landform along the Connecticut coast.

As is found in the suburban portions of the Long Island, the density of residential and commercial development increases as one travels from east to west along the coast. The Towns of Clinton, Madison, Guilford and Branford, while on the eastern edge of the greater New York metropolitan area maintain an upscale and quaint small town character. Although suburban land uses dominate, these town centers maintain a vital pedestrian streetscape with active restaurants, galleries, antique shops and other specialty shops catering to tourists as well as local residents. Clusters of commercial fishing ports, marinas, restaurants and specialty retail shops, and public parks are common in any number of small sheltered harbors along the coast as may be found in Clinton, Madison, Branford and Guilford. Waterfront residences are often large, well-appointed homes and older estates clearly oriented towards the water.

Numerous small town parks provide non-waterfront residents with their primary access to the waterfront. Hammonassett State Park in the Town of Madison provides a variety of waterfront day-use and camping activities for residents and visitors alike.

The Thimble Islands off of the coast in Branford are a unique archipelago of more than a two-dozen small rocky islands. More than 80 small homes are found on 23 of the islands (14 have only one), accessible only by boat. These islands are a scenic outpost on the Sound offering a quiet and charming way of life for seasonal residents and visitors.

Interstate I-95 closely parallels the coast from as nearby as a mile away. This heavily used limited access highway has opened old Connecticut to newer commercial and residential developments in similar fashion to The Long Island Expressway's opening of old Long Island. Parallel U.S. Route 1 and State Route 146 provides the primary east-west access between coastal communities and numerous local roads branch off to various residential neighborhoods found on the coastal peninsulas and bays.

Traveling eastward, suburban development along the coast gives way to an increasing urban fringe in the Town of East Haven. Coastal residences are typically smaller modest homes on minimally sized lots. Community scale retail shops line main streets catering to the working class neighborhoods typical of the New Haven Harbor area. The Tweed/New Haven airport is located on the east side of New Haven Harbor near Lighthouse Point in the City of New Haven and Town of East Haven.

The City of New Haven – Connecticut's second largest (pop, 126, 126) – is distinctly urban in character. The waterfront area along New Haven Harbor is substantially dedicated to public recreational uses. Lighthouse Point Park, Nathan Hale Park, and East Shore Park provide extensive access and recreational opportunities for local residents. The Port of New Haven is located in the northeast portion of New Haven Harbor. Piers extend into the harbor and nearly 100 petroleum storage tanks line the waterfront. New Haven Harbor is an important economic center with over 3,600 vessel trips annually. Numerous high-rise buildings are found in downtown New Haven, inland from harbor. The 448-megawatt New Haven Harbor Generating Station is also located along the harbor waterfront.

Interstate 95 parallels the north and west portions of New Haven Harbor offering views of manufacturing and warehousing. These land use activities are also commonly viewed along the waterfront. A recreational promenade parallels the west side of the harbor connecting the working waterfront land uses with working class neighborhoods at the head of the harbor. Inland from the harbor numerous high-rise buildings mark downtown New Haven.

The Town of West Haven is characterized by a mix of dense residential and commercial uses in close proximity to the waterfront. A nearly two-mile long linear park and public sand beach along the Sound extends from New Haven Harbor westward. Much of the remainder of the coastline between New Haven and Bridgeport in the Towns of West Haven, Milford and Stratford is comprised of relatively modest residential properties, many with direct frontage on the Sound. Public access is provided in numerous locations, most notably Silver Sands State Park and Walnut Beach Park in Milford.

Further west, at the Mouth of the Housatonic River, the Stratford Point and Lordship Beach neighborhoods in the Town of Stratford offer a mix of suburban scale waterfront residential and pedestrian access along the Sound. The Sikorsky/Bridgeport airport is also located near the waterfront on Stratford Point.

The Great Meadows Marsh complex at the mouth of the Housatonic River in the Towns of Milford and Stratford provides a unique break from the surrounding dense waterfront residential neighborhoods of this portion of the Connecticut coast.

The City of Bridgeport (pop. 140, 885) is the largest City in Connecticut with concentrated commercial, and industrial development along Bridgeport Harbor. Bridgeport Harbor is flanked to the east and west by heavily used Pleasant Beach Park and Seaside Park. Inland from these waterfront recreation areas are urban scale mixed-use working class residential neighborhoods, and commercial and industrial districts. The 513-megawatt Bridgeport Harbor Generating Station is a notable landmark along this portion to the Connecticut coastline. Inland from the harbor, numerous high-rise buildings mark downtown Bridgeport.

West of Bridgeport along the waterfront are well maintained suburban neighborhoods of the Town of Fairfield. Closely spaced, but well appointed, seaside residences line the Sound along Fairfield Beach and traditional suburban residential neighborhoods are found inland. Public access to the Sound in this area includes Jennings Beach, Rickards Beach, Penfield Beach, Sasco Beach, Southport Beach, Burying Ground Beach and Sherwood Island State Park.

As is the case with waterfront views anywhere, vistas of the Sound are highly valued and considered special by nearly all who live near, or visit the coastal area. The relative monotony of extended sand beaches or the more dynamic character of a rocky coastline does not matter. People have a universal attraction to the water. Moreover, there is little obvious diminishment in the public's enjoyment of the coast between rural and urban areas. Public beaches within the urban areas of Bridgeport and New Haven appear equally popular with the more rural beaches of eastern Long Island. While proximity to population centers is certainly a factor, the presence of urban or industrial land uses in close proximity to waterfront recreation does not appear to diminish public enjoyment of the resource. Examples of the coexistence of urban and industrial land uses include the ConocoPhillips Northville petroleum terminal adjacent to the Iron Pier Town Beach in the Town of Riverhead, the Shoreham Energy Center (former Shoreham Nuclear facility) adjacent to the Wading River municipal beach and Brookhaven Town Beach in the Towns of Riverhead and Brookhaven, and numerous public beaches and waterfront parks on New Haven Harbor.

Coastal views over the Sound appear dark on most nights due to limited atmospheric visibility and distance to light sources. Occasional dim flashes of navigational aids are noted in some areas of the coastline and brighter flashes of distant lighthouses are typical along both the Connecticut and Long Island coastlines. The navigational and deck lights of passing commercial and recreational vessels are also common.

From sea level (beach front) vantage points most coastal lights across the Sound are screened by the curvature of the earth. From elevated vantage points, distant coastal lights take a linear form low to the horizon. Visible lights vary in intensity and tend to have a shimmering effect due optical refraction at such extended distance. Subtle atmospheric illumination (sky glow) radiating from urban areas, including Port Jefferson on Long Island and New Haven and Bridgeport on the Connecticut coast is commonly visible across the Sound, particularly on nights of low cloud cover.

From all vantage points the proposed project will be viewed over open water at great distance (greater than nine [9] miles from any coastal vantage point). At such extended distance the curvature of the earth will affect the visibility of the proposed LNG terminal. The degree of screening caused by earth curvature depends on the elevation of the viewer above sea level (asl) and the distance of the viewer from the proposed project.

The degree of visibility above the visible horizon for any object can be geometrically calculated using the Pythagorean theorem ($a^2+b^2=c^2$). The distance that the target object will become visible above the horizon from a known vantage point is the sum of the distance between from the viewer location to the visible horizon and the distance from the target object to the visible horizon. Figure 4 illustrates this concept.

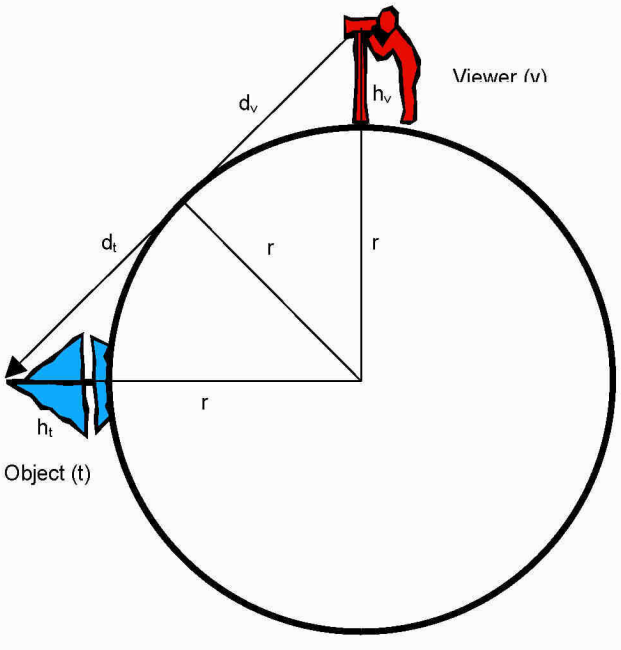
The distance to the geometric horizon from any point is calculated as follows:

From the Pythagorean theorem:

Simplifying;

Where;

the sightline distance between viewer (v) and target object (t) = dv+dt



Because the atmosphere bends light around the earth (atmospheric refraction) allowing a viewer to see farther, the distance to the optical horizon is slightly greater than the simple geometric calculation. The exact amount of bending depends on several variables including elevation, and the composition of the atmosphere (which varies with location, weather, etc.). A commonly accepted rule of thumb is that the optical horizon is approximately 10% greater than the geometric horizon. For this reason, geometric horizon calculations are multiplied by a factor 1.1 to adjust for this common optical effect. [3]

[3] A simple on-line calculator to determine the distance to the horizon can be found at http://www.boatsafe.com/tools/horizon.htm

Table 5 below summarizes the degree of visibility of the Project given varying viewer elevations and distance from the Project. For example, using Table 5; the lower 65 feet of the FSRU, YMS and LNG vessel would fall below the optical horizon to a viewer standing 28 feet above water level at a distance of 18 miles from the Project.

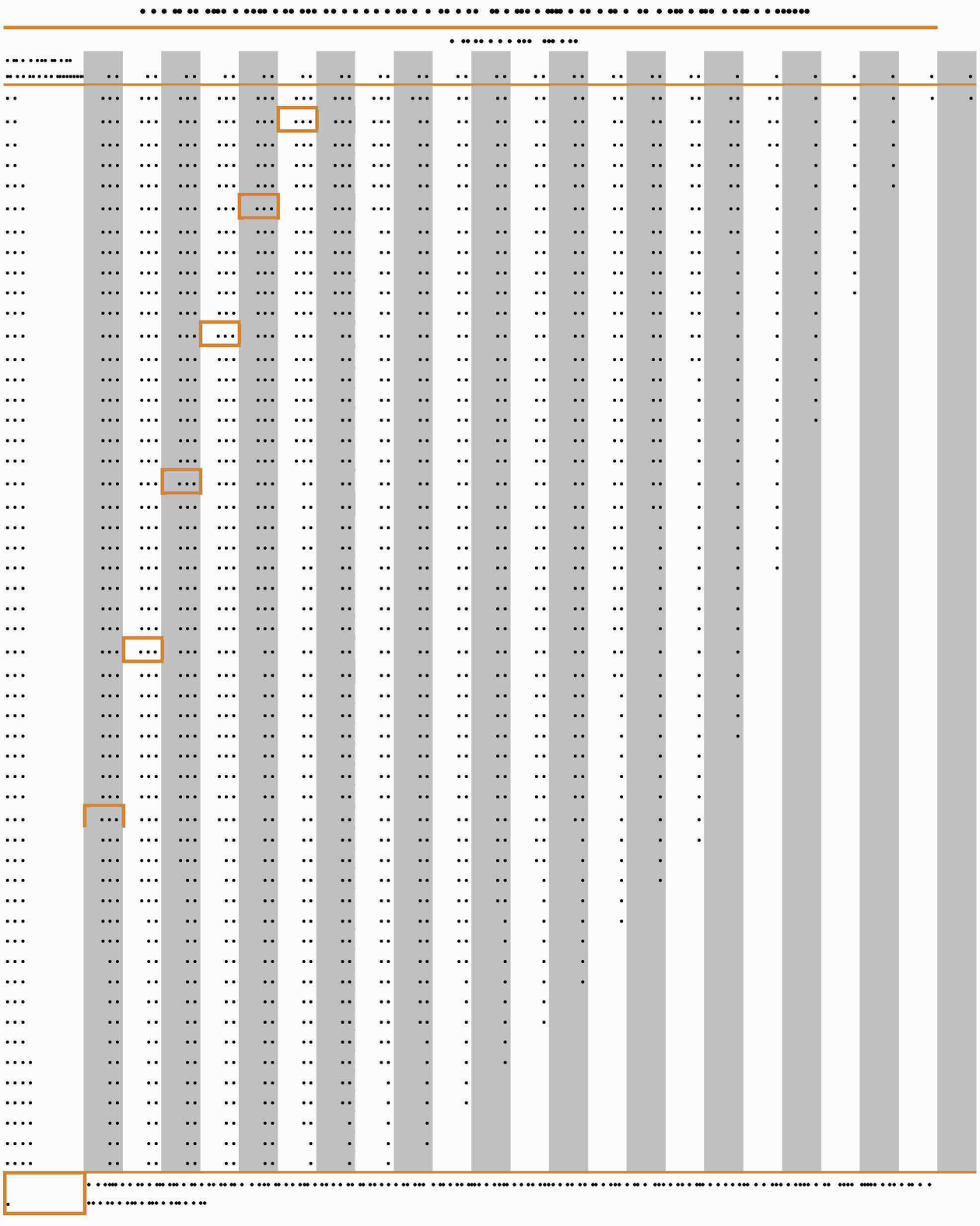


Table 6 below summarizes the sight distance for key components of the proposed LNG terminal from various viewing distances and viewer elevations.

		Observer standing at sea level	Observer standing 35 feet above sea level		

Because the proposed LNG terminal will be most often viewed over open water at great distances the effect of mirage will occasionally alter the appearance of the FSRU/YMS structures. A mirage is a naturally occurring optical phenomenon where distant objects appear displaced from their true position. The bending of light rays from thermal gradients in the atmosphere causes this optical displacement.

An "inferior mirage", the most common mirage type, forms when light rays passing through a relatively warm layer of air are bent upward from their path. The resulting image of distant objects may appear to be inverted and displaced downward. The farther away the object, the more of the lower portion of its image will vanish. For example, the upper decks of a distant ship might appear erect and inverted and apparently floating above and disconnected from the optical horizon while the lower decks will not be seen at all [4].

"Superior mirages" are much less common. Superior mirages are characterized by an image that is displaced upward from the position of the object. These occur mainly over the horizon of the sea when

[4] http://amsglossary.allenpress.com/glossary/search?id=inferior-mirage1

distant objects appear upside down in the sky. Sometimes there is an erect image of the same object that will be above the upside-down image. This is more common in cold areas and conditions with a strong change of temperature where warmer layers of air rise above the cooler layers.[5]

Some mirages have specific names:[6]

- [illegible] - appearance of objects usually hidden below the horizon. Normally occur over water surfaces when normal rate of air thickness decreases and altitude is heightened.
- [illegible] - reverse effect of the above phenomenon. Occurs when the opposite conditions at sea take place. In sinking, the vessels, boats and shorelines that are seen on the horizon, seem to sink below and become invisible.
- [illegible] - occurs due to irregular refraction. Light rays curve downward, with the top of the object curving more than the lower ones. The observer will see objects which seem to be lifted up more then they need to be and will be enlarged in the vertical direction.
- [illegible] - when the light rays of the distant object curve downward less than the rays at the bottom. This vertical contraction gives it this name. It results in objects on the horizon being observed with the rising or setting of the sun and the moon. One may often see a distortion caused by irregular layer effects of the lower atmosphere strata.
- [illegible]

Visibility can be reduced by fog, snow, particulate matter, smog or any combination of them, and is a part of normal atmospheric phenomena.

Table 7 below summarizes hourly visibility data as recorded by the National Weather Service (NWS) at Bridgeport, Ct. for a five-year period between 2000 and 2005. Based on this data, atmospheric conditions would obscure the proposed LNG terminal from all coastal receptors (9 miles or greater from the facility) approximately 24 percent of the time. This frequency is generally consistent throughout all seasons, ranging from 19 percent of the time during the fall months to 28 percent of the time during the summer months. There is also no significant variation between day and night conditions with the frequency ranging from 26 percent during daylight hours and 21 percent during the hours of darkness, on an annual basis.

It is important to note that NWS records hourly measurements of weather conditions including atmospheric visibility and precipitation type. Visibility is reported in quarter-mile increments up to two miles, then at 2.5 miles, then at every mile to a maximum of 10 miles. Visibilities greater than 10 miles are still reported as 10 miles. Therefore, it is a logical conclusion that actual visibility to distances significantly beyond 10 miles would occur less frequently than visibility limited to the reported 10 miles.

At any given time, it is possible that conditions of reduced visibility may exist in one portion of the viewshed, but not in another. For example, haze or fog may prevent visibility of the FSRU from

[5] http://www.light-science.com/desertmirage.html
[6] http://amsglossary.allenpress.com/glossary/search?id=inferior-mirage1

Connecticut while views of the Project from Long Island are unobstructed. Similarly, conditions of reduced visibility may also exist throughout the 25-mile study area preventing all coastal views of the FSRU at any given time.

	Annual		Winter (Dec 21-Mar 21)		Spring (Mar 22-Jun 21)		Summer (Jun 22-Sept 20)		Fall (Sept 21-Dec 20)		Extended Summer (May 14-Oct 25)[1]	

Distance

Distance affects the apparent size and degree of contrast between an object and its surroundings. Distance can be discussed in terms of distance zones, e.g., foreground, middleground and background. Distance zones established by the U.S. Forest Service and reiterated by the NYSDEC Visual Policy are used in this VRA. A description of each distance zone is provided below to assist in understanding the effect of distance on potential visual impacts.

Foreground

At a foreground distance, viewers typically have a very high recognition of detail. Cognitively, in the foreground zone, human scale is an important factor in judging spatial relationships and the relative size of objects. From this distance, the sense of form, line, color and textural contrast with the surrounding landscape is highest. The visual impact is likely to be considered the greatest at a foreground distance.

With the nearest coastal vantage point over nine (9) miles distant, only boaters passing within very close proximity will view the Project from the foreground distance zone. With the outer margin of the

foreground distance zone at least 8.5 miles off shore, the number of vessels passing within ½ mile of the proposed LNG terminal is expected to be very limited considering smaller watercraft typically navigate much closer to shore. Moreover, for security reasons, the USCG will likely establish safety/exclusion zones in conjunction with FSRU limiting the distance at which vessels can pass.

With the FSRU hull nearly 1,250 feet (381 m) long and rising 102 feet (31 m) above waterline, at such close range the LNG terminal will dominate the scene and be the overwhelming visual point of interest to boaters passing in such close proximity. Figure A-2A, below illustrates the proposed LNG terminal from the foreground distance zone.

This is the distance where elements begin to visually merge or join. Colors and textures become somewhat muted by distance, but are still identifiable. Visual detail is reduced, although distinct patterns may still be evident. Viewers from middleground distances characteristically recognize surface features such as tree stands, building clusters and small landforms. Scale is perceived in terms of identifiable features of development patterns. From this distance, the contrast of color and texture are identified more in terms of the regional context than by the immediate surroundings.

Boaters passing within three (3) miles will view the Project from the middleground distance zone. With the outer margin of the Middleground distance zone at least six (6) miles off-shore, the number of vessels passing within three (3) miles of the proposed LNG terminal is expected to be relatively limited considering smaller watercraft typically navigate much closer to shore.

Due to the scale of the FSRU/YMS and LNG vessel visible within the context of an open water setting, the proposed LNG terminal will remain easily distinguishable and a visually dominant element from middleground vantage points. Figure A-2B below illustrates what the proposed LNG terminal will look like from the middleground distances

At this distance, landscape elements lose detail and become less distinct. Atmospheric perspective[7] changes colors to blue-grays, while surface characteristics are lost. Visual emphasis is on the outline or edge of one landmass or water resource against another with a strong skyline element.

With the nearest coastal vantage point more than nine (9) miles away, only boaters will view the Project from near-background distances (5-9 miles). While noticeably less dominant and visually less distinctive, the FSRU/YMS and LNG vessel will remain a point of interest over open water under clear weather conditions. The visual complexity of deck infrastructure will blend as a monochromatic two-dimensional profile of the overall structure. Within the context of open water the LNG terminal

[7] Atmospheric Perspective: Even on the clearest of days, the sky is not entirely transparent because of the presence of atmospheric particulate matter. The light scattering effect of these particles causes a reduction in the intensity of colors and the contrast between light and dark as the distance of objects from the observer increases. Contrast depends upon the position of the sun and the reflectance of the object, among other items. The net effect is that objects appear "washed out" over great distances.

will remain a point of visual interest for an extended distance, although decreasing in visibility, clarity and perceived importance with increasing distance.

All shoreline receptors will view the proposed Project within the far background distance zone. On clear days the FSRU/YMS and LNG vessel may be a point of interest for viewers at the closest vantage points along the in New York and Connecticut coastlines. However, the proposed LNG terminal will decrease in visibility and perceived importance for receptors at further distances up and down the coast. Figure A-2C and D below illustrate the proposed LNG terminal from the background distance zone.

Viewers engaged in different activities while in the same setting are likely to perceive their surroundings differently. The description of viewer groups is provided to assist in understanding the sensitivity and probable reaction of potential observers to visual change resulting from the proposed project.

One of the coastal area's greatest assets is the scenic quality of the Sound and its shoreline landscape. The Connecticut and Long Island coast have long been a popular tourist destination offering a broad-spectrum of land and water based recreational opportunities.

- Popular land based activities include simple enjoyment of passive pursuits, such as picnicking, sunbathing, shoreline fishing, walking along the beach, bird watching, or other forms of passive recreation while enjoying the scenic coastal setting. Others dine at restaurants and shop in quaint coastal villages, or a take leisurely drives. Many engage in more active pursuits such as bicycling, golf, swimming, and tennis.

- Popular water based recreation includes fishing, paddling, sailing, and power boating. Charter services also provide visitors with opportunities for offshore fishing and sightseeing.

Tourists, vacationers and recreational users, particularly those enjoying leisurely pursuits from coastal or on-water locations will likely be most sensitive to the presence of the proposed LNG terminal. While the sensitivity of these viewers will vary, to most quality views of the Sound are an important an integral part of the recreational experience.

The presence of the LNG terminal and commercial LNG supply ships may diminish the aesthetic experience for those that believe that the Sound should be used strictly for recreational purposes. For those who recognize and understand that the Sound is a multi-purpose body, the presence of the proposed LNG terminal and LNG carriers will have little aesthetic impact on their recreational experience.

While the unique character of Sound views is an important aspect of the recreational experience for most shoreline visitors, viewers will also be cognizant of various beach foreground details and

developments and other visually proximate activities along the shore. Tourists, vacationers and recreational users currently view existing on-shore power plants and other industrial uses as well as large commercial vessels that ply the waters of the Sound within the Project's viewshed.

Greater numbers of tourists, vacationers and recreational users will be present in the coastal area, when the weather is clear and warm as compared to overcast, rainy or cold days. In addition, more recreational users will be present in the coastal area on weekends and holidays than on weekdays.

As previously described the coastal area includes numerous of private residential properties (both permanent and second homes) along the Connecticut and Long Island coastlines that are uniquely oriented to take advantage of scenic Sound views. These properties are almost always of very high real estate value, due in large part to coastal views, and are often cherished places for families who live or vacation there.

Local residents are likely to have the best understanding of the aesthetic character and existing conditions of the Sound. Except when involved in local travel, these viewers are likely to be stationary and may have frequent and/or prolonged views of the Project. They know the Sound and may be sensitive to changes in particular views that are important to them. Many coastal residents may feel that the presence of the FSRU/YMS and LNG carriers diminishes aesthetic enjoyment of the property to some degree even at great distances offshore. Such sensitivity may fade over time as local residents become accustomed to the visual change.

This group includes non-local viewers such as travelers along roads with views of the Sound, However, extensive site inventory found few major thoroughfares with significant or extended views of the Sound.

Also included in this group are travelers that may transit the Sound on the Port Jefferson/Bridgeport ferry. Unlike automobile users, ferry passengers have extended periods of time where views of the proposed project would be of relatively long duration (approximately 1 hour). These viewers include those engaged in passive enjoyment of the Sound ambiance as well as those who pass the travel time occupying themselves with business or other personal activities. The closest the Port Jefferson/Bridgeport ferry comes to the proposed LNG terminal is approximately 15 miles.

At its closest, the Orient/New London ferry passes within 31 miles of the Project. At this distance the Project will not be visible above the horizon. At times, the arrival of an LNG supply vessel will travel in close proximity to the Orient Point/New London Ferry. It is likely that many ferry passengers will observe the LNG vessel with interest and even fascination. Additionally, numerous large commercial vessels traverse the Ferry route on an annual basis. As such the LNG carrier would simply be in addition to the existing traffic volume.

Commercial fisherman and seaman transiting the sound would typically have low sensitivity to the presence of the FSRU/YMS and LNG carrier vessels. These viewers would be engaged in activities associated with their jobs with minimal focus on the aesthetic character of their surroundings. Moreover, commercial mariners would be more accustomed to the presence of industrial activities and ocean-going vessels within their day-to-day environment that other viewer types.

The analysis of a viewer's experience must include the distinction between stationary and moving observers. The length of time and the circumstances under which a view is encountered is influential in characterizing the importance of a particular view.

Stationary views are experienced from fixed viewpoints. Fixed viewpoints include residential neighborhoods, recreational facilities, historic resources and other culturally important locations. Characteristically, stationary views offer sufficient time, either from a single observation or repeated exposure, to interpret and understand the physical surroundings. For this reason, stationary viewers have a higher potential for understanding the elements of a view than do moving viewers.

Stationary views can be further divided into those of short-term and those of long-term exposure. Sites of long-term exposure include locations where a stationary observer is likely to be regularly exposed to the project such as from a place of residence or employment. Sites of short-term exposure include locations where a stationary observer is only visiting, such as beaches or other coastal recreation areas. The duration of visual impact remains at the discretion of the individual observer; however, short-term impacts diminish with repeated observations by the same observer (people become accustomed to common views).

Moving views are those experienced in passing, such as from moving land-based or water-based vehicles and craft, where the time available for a viewer to cognitively experience a particular view is limited. Typically such views apply to motorists proceeding at a high rate of speed along a defined path through highly complex stimuli.

Traveling at a slower speed over open water, recreational boaters may have greater opportunities to cognitively experience their surroundings. For sailboats and very slow moving motor craft, visual recognition may be similar to that described for stationary viewers. Though for reasons of safety including avoidance of other vessels and surface flotsam, a boater may nevertheless still tend to focus more on the direction of travel than other directions.

The first step in identifying potentially affected visual resources is to determine whether or not the proposed project would likely be visible from a given location. Viewshed maps are prepared for this purpose. Viewshed mapping identifies the geographic area within which there is a relatively high probability that some portion of the proposed project would be visible. For this evaluation, ArcView 3D Analyst GIS software was used to generate the viewshed maps. The control points for viewshed development was the tallest Project structure; the emergency burn-off gas flare on the FSRU (elevation 279 feet [85 m] above water line).

Viewshed maps were prepared illustrating the probable screening effect of intervening topography and existing mature vegetation (see Figure A-1 in Appendix A). This treed condition viewshed, although not considered absolutely definitive, acceptably defines the geographic area within which one would expect to be substantially screened by intervening forest vegetation. By themselves, the viewshed maps will not determine the degree or character of visual impact, but rather identify the geographic area within which there is a relatively high probability that some portion of the proposed project would be visible. Their primary purpose is to assist in determining the potential visibility of the proposed project from the identified visual resources and to help limit the geographic extent of study to only those areas where project visibility is possible.

The viewshed database was prepared by first creating a digital terrain model (DTM) of the study area based on available digital USGS (1:24,000 scale) topographic data. A three dimensional grid was then generated on top of the DTM. The computer then essentially scaned 360 degrees across this grid from the selected control point (FSRU flare). Grid cells that are hidden from view and those that are visible were then identified. The screening effect of potential intervening vegetation was incorporated by adding a conservative height to those grid cells that are completely forested (according to a Multi-Resolution Land Characteristics [MRLC] dataset) and repeating the procedure.

To develop each individual viewshed map, a digital base map was prepared using 1:24,000-scale USGS digital Raster Quadrangles obtained through NYS GIS Clearinghouse and the University of Connecticut Map and Geographic Information Center. In this evaluation, ArcView 3D Analyst and ArcInfo GIS software were used to generate a viewshed overlay map based on publicly available digital topographic and vegetation data sets. Viewshed overlays were created by first importing a digital elevation model (DEM) of the study area. This DEM, obtained through US Geological Survey Earth Resources Observation and Science Data Center (USGS EROS), is based on 1:24,000-scale USGS topographic maps (10-foot contour intervals) and is accurate to a 30-meter grid cell resolution. The computer then scanned 360 degrees across this DEM from the control point (FSRU flare), distinguishing between grid cells that would be hidden from view and those that would be visible based on topography only. An appropriate analogy would be to think of a light bulb located at the control point. Areas of the surrounding landscape that are illuminated by the bulb would potentially be visible; areas in shadow would not be visible.

Vegetation data was extracted from the Multi Resolution Land Characteristics (MRLC) data set, also obtained through USGS EROS. The MRLC data set was developed from Thematic Mapper (TM) LandSat imagery (1992) and is accurate to a 30-meter grid cell resolution.[8] The screening effect of vegetation was then incorporated by adding 40 feet in height to DEM grid cells that are completely forested (according to MRLC data set) and repeating the calculation procedure. Based on field observation, most trees in forested portions of the coastal area are significantly taller than 40 feet. This height thus represents a conservative estimate of the effect of vegetative screening.

It is important to note that the MRLC dataset is based on interpretation of forest areas that are clearly distinguishable from infrared satellite imagery. As such, the potential screening value of site-specific vegetative cover such as small hedgerows and individual trees and other areas of non-forest tree cover may not be represented in the viewshed analysis. The potential screening value of existing structures is also not considered. With these conditions, the viewshed map conservatively over estimates potential project visibility in areas where, in reality, the project may be substantially screened from view. Moreover, the viewshed map indicates locations in the surrounding landscape in which the only the upper portion of the FSRU emergency burn-off flare structure (control point) might be visible. The map does not imply the magnitude of visibility (i.e., how much of the FSRU is visible) or the character of what may be seen.

The viewshed illustrates that the vast majority of views of the proposed LNG terminal structures will be limited to immediate shoreline locations. In most locations project visibility is quickly screened from potential inland vantage points by dense coastal vegetation, topography and structures. Few publicly accessible vantage points with views of the Sound were found more than several hundred yards inland along both the Long Island and Connecticut coastline. While there are discrete exceptions (Sleeping Giant and West Rock Ridge State Parks in Hamden, CT being most notable), viewshed analysis demonstrates that views of the proposed LNG terminal will be substantially limited to beachfront locations.

The north shore of Long Island includes nearly 55 miles of coastline within the 25-mile study radius. Based on viewshed analysis, the proposed LNG terminal will be visible from approximately 44 miles of coastline (80%) and will be screened by intervening landform along approximately 11 miles (20%). The project will be visible along nearly the entire Long Island coastline between Port Jefferson, NY and the eastern limit of the 25-mile study radius in Greenport, NY. In this area the coastline is a subtly concave form with few intervening peninsulas. To the west of Port Jefferson, Crane Neck peninsula extends northward into the Sound providing a visual barrier for the coastal area within Smithtown Bay extending to the western extend of the 25-mile study area in Kings Park, NY.

The Connecticut side of the Sound within the 25-mile study radius includes nearly 92 miles coastline including harbors (i.e., Bridgeport, New Haven, Branford, Gilford, Clinton, and Westbrook Harbors)

[8] Thirty-meter resolution is the smallest vegetative grid cell increment commonly available for the project region. This resolution provides an appropriate degree of accuracy for development of twenty-five-mile viewshed maps given the fairly broad patterns of existing land use in the coastal area, as well as the accuracy of mapped topographic data (i.e., 1:24,000-scale USGS topographic maps with 10-foot contour intervals)

and smaller bays. Based on viewshed analysis, the proposed LNG terminal will be visible from approximately 46 miles of (50%) of the Connecticut coastline within he study area and will be screened by intervening landform along the remaining 46 miles (50%) of coastline. Areas of visibility and non-visibility are relatively evenly distributed throughout the coastal area with numerous concave bays, inlets and peninsulas providing varying directions of view depending on coastal orientation. For example, views are principally oriented to the southwest (toward the Project) on the west side of Sachem Head in the Town of Guilford, Ct and views are oriented to the southeast (away from the project) on the eastern side of the same landform.

Because it is not practical to evaluate every conceivable location where the proposed project might be visible it is accepted visual assessment practice to limit detailed evaluation of aesthetic impact to locations generally considered by society, through regulatory designation or policy, to be of cultural and/or aesthetic importance. For this reason, visual analysis focuses on specific receptors that are expressly protected by regulatory authority due to recognized cultural, recreational or scenic importance (resources of statewide significance), and places that hold local sensitivity or otherwise maintain a high intensity of use (resources of local interest).

The DEC Visual Policy requires that all aesthetic resources of statewide significance be identified along with any potential adverse effects on those resources from the proposed project. Aesthetic resources of statewide significance may be derived from one or more of the following categories:

- A property on or eligible for inclusion in the National or State Register of Historic Places [16 U.S.C. § 470a et seq., Parks, Recreation, and Historic Preservation Law Section 14.07];
- State Parks [Parks, Recreation, and Historic Preservation Law Section 3.09];
- Urban Cultural Parks [Parks, Recreation, and Historic Preservation Law Section 35.15];
- The State Forest Preserve [NYS Constitution Article XIV], Adirondack and Catskill Parks;
- National Wildlife Refuges [16 U.S.C. 668dd], State Game Refuges, and State Wildlife Management Areas [ECL 11-2105];
- National Natural Landmarks [36 CFR Part 62];
- The National Park System, Recreation Areas, Seashores, and Forests [16 U.S.C. 1c];
- Rivers designated as National or State Wild, Scenic, or Recreational [16 U.S.C. Chapter 28, ECL 15-2701 et seq.];
- A site, area, lake, reservoir, or highway designated or eligible for designation as scenic [ECL Article 49 or DOT equivalent and APA], designated State Highway Roadside;
- Scenic Areas of Statewide Significance [of Article 42 of Executive Law];
- A State or federally designated trail, or one proposed for designation [16 U.S.C. Chapter 27 or equivalent];

- Adirondack Park Scenic Vistas [Adirondack Park Land Use and Development Map];
- State Nature and Historic Preserve Areas [Section 4 of Article XIV of the State Constitution];
- Palisades Park [Palisades Interstate Park Commission]; and
- Bond Act Properties purchased under Exceptional Scenic Beauty or Open Space category.

Places of local sensitivity or intensity of use (based on local context) were also inventoried, even though they may not meet the broader statewide threshold. Aesthetic resources of local interest were generally derived from the following general categories:

- Recreation areas including playgrounds, athletic fields, boat launches, fishing access, campgrounds, picnic areas, ski centers, and other recreational facilities/attractions;
- Areas devoted to the conservation or the preservation of natural environmental features (e.g., reforestation areas/forest preserves, wildlife management areas, open space preserves);
- A bicycling, hiking, ski touring, or snowmobiling trail designated as such by a governmental agency;
- Architectural structures and sites of traditional importance as designated by a governmental agency;
- Parkways, highways, or scenic overlooks and vistas designated as such by a governmental agency;
- Important urban landscape including visual corridors, monuments, sculptures, landscape plantings, and urban green space;
- Important architectural elements and structures representing community style and neighborhood character;
- An interstate highway or other high volume (relative to local conditions) road of regional importance; and
- A passenger railroad or other mass transit route.

Resources of statewide significance and resources of local interest were identified though a review of published maps and other paper documents, online research, extensive windshield survey of publicly accessible locations long the Long Island and Connecticut coastlines and request for information from coastal municipalities.

The Connecticut and Long Island coastal area includes numerous private residential properties (both permanent and second homes) that are clearly oriented to take advantage of scenic Sound views. These properties are found at beach level and on surrounding hillsides with unimpeded views towards the Sound. Because of these views, these homes are almost always of very high real estate value and are

often cherished places for families who live or vacation there. The coastal area is also a popular seasonal tourist destination. Visitors to waterfront hotels and smaller bed and breakfast type establishments, open to the general public, choose to vacation along the Sound to enjoy the scenic, recreational, social, peaceful and cultural ambiance of the coastal landscape.

For many reasons, evaluation of potential visual impacts from private property, not ordinarily publicly accessible, is not standard practice under any visual assessment methodology. Inventorying all potentially affected properties is obviously not a practical alternative. Evaluating sample private properties creates the inherent issue of fairness in selectively evaluating one property, but not another. Moreover, such selective analysis tends to exaggerate the perceived magnitude of visual impact by placing emphasis on views unavailable to the general public. Instead, standard visual resource assessment protocol evaluates surrogate publicly accessible locations that are equal to, or more revealing of the impact that would be experienced from such private properties. This is the protocol followed by this VRA.

Eight (8) communities along the Sound have approved Local Water Revitalization Plans (LWRPs) that further expand upon the NYSDOS Long Island Sound coastal policies, with specific emphasis on town resources.

Of these eight communities, six (6) are located beyond the 25-mile study radius and will not be visually affected by the project. Sound front communities with approved LWRP's more than 25 miles from the Project include:

- Village of Bayville (39 miles);
- Village of Lloyd Harbor (34 miles);
- Village of Mamaroneck (47 Miles);
- Town of Mamaroneck/Village of Larchmont (48 miles);
- Village of Port Chester (43 miles); and
- City of Rye (43 miles).

Two (2) approved LWRP communities are located within the 25-mile study radius. These are:

- Town of Smithtown (24 miles); and
- Village of Head-of-the-Harbor/Village of Nissequogue (21 miles)

From both of these coastal areas the proposed Project will be completely screened by the intervening Crane Neck peninsula, in the Town of Brookhaven, Suffolk County (refer to Figure A-1 in Appendix A). Consequently, neither of these LWRP coastal areas communities will be visually affected by the proposed project.

Table 8 lists 228 visual sensitive resources located within the study area. The location of these visual resources is referenced by numeric code within Figure A-1 in Appendix A.

. . . .	. . . . .	. . . . .	. . . . .	. . . .	. . . . .	. . . . .	. . . .
. . . .	. . . . .	. . . . .	. . . . .	. . .	. . . .	. . . . .	. . . .

Although the possibility of visual impact has been identified for all potentially affected visual resources, a subset of key receptors was selected from which a more detailed analysis was conducted. Selection criteria included:

- Receptors within each of the three distance zone categories (foreground, middleground and background);
- Port Jefferson/Bridgeport Ferry views;

- Geographic distribution including landside receptors in closest proximity to the proposed project along both the Long Island and Connecticut coastlines, as well as incremental distances out to the 25 mile study limit.
- At least one landside receptor was included within each coastal municipality within the 25-mile study area.
- Relative importance of public vantage points, such as recreational, cultural and aesthetic resources designated or protected as a matter of public policy;
- Views from higher elevations along shoreline bluffs
- Level of viewer exposure, based on the relative number or frequency of viewers; and

Viewpoints selected for more detailed analysis include:

Photo realistic simulations of the proposed FSRU were prepared for each of the 26 key receptors selected.

Daytime photographs were taken from each key visual resource on May 18 and 19, 2005 and October 18, 19 and 20, 2005. To determine the direction of the FSRU from each receptor the precise coordinates of the FSRU were pre-programmed into a handheld Global Positioning System (GPS) as a "waypoint." The GPS waypoint direction indicator (arrow pointing along calculated bearing) was used to determine the appropriate bearing for the camera, so that the FSRU would be generally centered in the field of view of each photograph.

Photographs were taken with a digital camera using a lens focal length setting of 53 mm to approximate normal human eyesight relative to scale. The location selected for each photograph was judged by the field observer to be the most unobstructed vantage point of highest elevation within the subject visual resource.

Field visits were conducted under generally clear weather conditions with offshore visibility observed to be greater than 25 miles. To the degree possible, photographs were taken at a time of day when the sun was to the back of the photographer to minimize the effect of glare within the camera's field of view and to maximize visible contrast of the landscape being photographed.

To illustrate anticipated visual changes resulting from the proposed project, photographic simulations were prepared for each of the 26 key receptors. Photo simulations were developed by superimposing a rendering of a three-dimensional computer model of the proposed project into the base photograph taken from each corresponding visual resource. The three-dimensional computer model, covering the all of the water surface and shoreline terrain within the study area, was developed in Autodesk Architectural Desktop, AutoDesk Land Development Desktop software and Autodesk Viz (Viz) software.

- The process starts by constructing a three-dimensional computer model of the proposed FSRU/YMS, LNG vessel and attending tug boats based on two-dimensional design documents (provided by Broadwater Energy). The three-dimensional model was constructed using exact design dimensions and specifications in sufficient detail to be visually representative of the proposed project.

A three-dimensional digital terrain model of both the Connecticut and Long Island coastlines and water surface was also constructed using AutoDesk Land Development Desktop software for geographic orientation. The proposed LNG terminal structures, digital terrain model and GPS recorded camera coordinates were then imported into a single 3D model file in Autodesk Viz software. All model components were constructed using a common coordinate system, (UTM NAD 1983) to assure accurate alignment.

- Simulated perspectives (camera views) were then matched to the corresponding base photograph for each simulated view by replicating the precise UTM coordinates of the field camera position (as recorded by GPS) and the focal length of the camera lens used (53mm). Precisely matching these parameters assures scale accuracy between the base photograph and the subsequent simulated view. The center of the LNG terminal was set as the camera's target position. With the existing conditions photograph displayed as a "viewport background," minor camera adjustments were made (horizontal and vertical positioning, and camera roll) to align the horizon in the background photograph with the corresponding features of the 3D model.

- The effect of atmospheric haze is included in the photo simulation calculations. To achieve this effect, the Autodesk VIZ "fog" atmosphere environment is activated. This environment setting is programmed to calculate atmospheric haze of uniform density throughout the study area with an object becoming completely obscured at a distance of 50 miles. More simply stated, objects 50 miles from the observer would appear 100 percent obscured, objects 25 miles from the observer would appear 50 percent obscured and so on. Fifty-mile visibility is believed to be an overly conservative estimate of the atmospheric visibility over the Sound observed on the days the photographs were taken; resulting in a worst-case simulation of LNG terminal visibility within the context of the existing condition photographs.

– The baseline vertical elevation (Z coordinate) of the 3D model was established at 0 feet representing sea level. To account for the affect of earth curvature, the Z coordinate was adjusted downward equal to the distance (height) of the portion of the proposed LNG terminal falling below the

optical horizon given the horizontal distance and viewer elevation of each simulated viewpoint (refer to Table 5 on page 27).

For example, based on Table 5, at a distance of 15 miles and a viewer elevation of 20 feet above water level, the lower 44 feet of the LNG terminal would fall below the optical horizon. In this case, to account for 44 feet of the facility hidden by the horizon in the subsequent photographic simulation, the waterline elevation of the 3D model (Z coordinate) of the LNG terminal was adjusted from 0 to minus (–) 44 feet. When rendered, the portion of the simulated LNG terminal lying below the optical actual horizon line visible in the base photograph was airbrushed out during postproduction editing; leaving only the portion of the LNG terminal falling above the optical horizon visible in the final photographic simulation.

[illegible] - Consistent with the objective of illustrating worst-case visual conditions, the FSRU is oriented to present a near broadside view from each simulated vantage point.

[illegible] - The proposed condition model was rendered at the same image aspect (1.33), and using the base photograph as a background environment map. The 3D model was rendered using sunlight settings approximating the date and time of day the base photograph was taken. To the extent practicable and to the degree necessary to reveal impacts, conceptual design details of the proposed facilities were built into the 3D model and incorporated into the photo simulation. Consequently, the scale, alignment, elevations and location of the visible elements of the proposed facilities are true to the conceptual design. The rendered view was opened using Adobe Photoshop 7.0 software for post-production editing (i.e., airbrush out portion of FSRU that falls below optical horizon).

[illegible]

Nighttime simulations of the proposed project were prepared from several key receptors to illustrate the visual character of project lighting.

It is important to note that light simulation software does not replicate human perception of lighting. Similarly, existing condition photography cannot illustrate actual illumination and glare experienced in the field by the human eye. Software renderings are included to provide a general understanding of lighting as it may appear from off-site locations.

Since a detailed lighting plan for the project has not been prepared, certain broad based assumptions concerning probable lighting conditions were made considering the project sponsor`s current expectations. These assumptions are consistent with the preliminary exterior lighting requirements summarized in Table 2 on page 10. Table 10 indicates the lighting parameters used in development of the 3D lighting model.

Figure 4C and F above provide an aerial perspective of the night lighting model of the FSRU, and YMS structures.

Table 11 identifies the key receptors simulated for night lighting.

Figure A-2E							
Figure A-2F							
Figure A-2G							
Figure A-2H							
Figure A-6E							
Figure A-9E							
Figure A-18E							
Figure A-19E							

Night condition simulations are found following the corresponding daytime photo simulations in Figure A-2 through Figure A-24 in Appendix A.

– The photo simulations contained in Appendix A have been printed using an 11"x17" page format. At this image size, the page should be held at approximately arms length[9] so that the scene will appear at the correct scale. Viewing the image closer would make the scene appear too large and viewing the image from greater distance would make the scene appear too small compared to what an observer would actually see in the field.

For viewing photo simulations at other page sizes (i.e., computer monitor, projected image or other hard copy output) the viewing distance/page width ratio is approximately 1.5/1. For example, if the simulation were viewed on a 42-inch wide poster size enlargement, the correct viewing distance would be approximately 63 inches; or 5 ¼ feet.

- The photo simulations present an accurate depiction of the appearance suitable for general understanding of the degree and character of Project visibility. However, these images are a two-dimensional representation of a three-dimensional landscape. The human eye is capable of recognizing a greater level of detail than can be illustrated in a two-dimensional image. Agency decision-makers and interested parties may benefit from viewing the photo simulations in the field from any or all of the simulated vantage points. In this manner, observers can directly compare the level of detail visible in the base photograph with actual field observed conditions.

[9] Viewing distance is calculated based a 37.5-degree field-of-view for the 53mm camera lens used, and the 15.5" wide image presented in Appendix A. "Arm's length" is assumed to be approximately 22.5 inches from the eye. Arm's length varies for individual viewers.

Figure A-2 through Figure A-24 below provide a photographic analysis depicting project visibility from key receptor locations. A summary table is also provided within these figures identifying visible Project components, degree of visibility above the optical horizon and, duration of view, distance zones and affected viewer groups.

The visual character of a landscape is defined by the patterns, forms and scale relationships created by lines, colors, and textures. Some patterns dominate while others are subordinate. The qualitative impact of a project is the effect the development has on these patterns, and by corollary on, the visual character of the regional landscape.

The following describes the compatibility of the proposed project with regional landscape patterns within which it is contained and viewed. This evaluation is graphically depicted in the photographic simulations provided in Section 4.5 above.

- The regional landscape within the Project viewshed is almost entirely comprised of the Sound and its immediate shoreline. The patterns of this open water are temporal, changing with wind, sunlight and other factors that affect the texture and colors of the surface. While visible to observant viewers on clear days, the opposite shoreline is little more than a subtle linear form low on the horizon and often goes unnoticed due to extended distance and atmospheric perspective (hazing).

The proposed facility generally appears as a small rectangle on the horizon from distant coastal vantage points. Although a relatively small element within the context of the Sound, the geometric form of the LNG terminal is visible slightly above the horizon and contrasts with the expansive planar form of the Sound and sky.

– The shoreline of the Sound, as well as the horizon line, generally creates a clearly defined linear pattern. Quite often however, due to atmospheric perspective (hazing), there is little discernable distinction between land, water and sky defining the distant horizon. The combined composition of the proposed LNG terminal and LNG vessel is a relatively complex compilation of horizontal, vertical and diagonal lines. However from distant coastal vantage points, the perceived value of these disparate lines tends to viewed as the a more simple two-dimensional outline of the overall rectilinear form. While the outline of the Project will break the visible horizon, from distant coastal vantage points the Project will appear quite low and at times difficult to distinguish from the horizon.

– Due to the effect of atmospheric perspective (hazing), the proposed project will often appear a relatively uniform blue-gray in color from distant coastal vantage points. In this setting, the color will be highly consistent with the surrounding foreground open water and background low sky and distant coastline horizon. Color contrast will decrease with increasing distance. In addition, color contrast from on-water or the nearest shoreline receptors will diminish or disappear completely during periods of haze, fog or precipitation.

[illegible] – The texture of the open water viewed out to the horizon is smooth. Foreground views of the facility reveal complex structural components creating a notable contrast in texture. Such textural contrast is substantially diminished with distance as structural complexity becomes less obvious and obscured by both size and atmospheric perspective (hazing).

[illegible] – The proposed LNG terminal will be the largest moored object on the Sound. Ocean-going freighters may appear similar in size, however such vessels are transient and comparative views that reveal relative size are fleeting.

[illegible] – Long Island Sound is the dominant regional feature within view. With the nearest coastal vantage point approximately nine (9) miles distant, the proposed LNG terminal will be a point of visual interest within the open water landscape, but visually subordinate to the Sound itself.

[illegible]

The FSRU will be constructed in an off-site shipyard and towed to the project site to be connected to the YMS. The YMS will be constructed in place and will require temporary mooring of several barges and floating cranes. All construction vessels will be substantially smaller than the proposed FSRU. Therefore visual impact during the construction period is expected to be of lesser degree than the impact described above for the completed project.

Construction of the subsea interconnect pipeline will require use of temporarily moored barges and cranes lowering pipeline segments to the sea floor. These vessels will be moved along the route of the pipeline as construction progresses and are not expected to result in adverse prolonged visual impact to distant coastal vantage points.

For both YMS installation and subsea pipeline construction, supply barges and other construction vessels are expected to transit the Sound from staging ports outside of the study area. These vessels will be relatively infrequent and will be indistinguishable from other commercial barges that commonly ply the waters of the Sound.

[illegible]

Coastal views over the Sound appear dark on most nights due to limited atmospheric visibility and distance to light sources. Occasional dim flashes of navigational aids are noted in some areas of the coastline and brighter flashes of distant lighthouses are typical along both the Connecticut and Long Island coastlines. The navigational and deck lights of passing commercial and recreational vessels are also common.

From sea level (beach front) vantage points most coastal lights across the Sound are screened by the curvature of the earth. From elevated vantage points, distant coastal lights take a linear form low to the horizon. Visible lights vary in intensity and tend to have a shimmering effect due optical refraction at such extended distance. Subtle atmospheric illumination (sky glow) radiating from urban areas, including Port Jefferson on Long Island and New Haven and Bridgeport on the Connecticut coast is commonly visible across the Sound, particularly on nights of low cloud cover.

The Project includes FAA obstruction to aviation lighting and a maritime navigation aids system. These are federally mandated safety features and cannot be omitted or reduced.

The maritime navigation aids system will include white colored lights, flashing Morse U at 30 second intervals and visible for 10 nautical miles (11.5 statute miles) from points 5m above sea level. Subsidiary warning lights, to be located along the port and starboard sides of the FSRU, will be red colored and visible for 2 nautical miles (2.3 statute miles) from points 5m above sea level. These maritime obstruction lights are consistent with navigation aid systems commonly found throughout the Long Island Sound.

According to FAA Advisory Circular AC70/7460-1K. Structures that exceed an overall height of 200 feet (61m) above ground level should normally be marked and/or lighted. The emergency burn-off flare (279 feet [85 m]) is the only structure exceeding this height. It is likely that the FAA will require this structure to be illuminated with red flashing aviation obstruction lights (L-864, 20-40 flashes per minute) mounted at the top and mid-point of the tower. Because the Project includes a helideck (for emergency transport only), one (1) red flashing aviation obstruction light (L-864) will also be mounted on the radar mast (177 ft [54 m]).

Such aviation obstruction lighting is similar to red flashing nighttime obstruction lights commonly found on radio/transmission towers and tall industrial facilities commonly found throughout the Long Island and Connecticut coastlines.

Such maritime and aviation obstruction lighting is designed with sufficient intensity to provide ample warning to mariners and pilots in close proximity to the obstruction. At distances of nine (9) miles and greater from the nearest coastal vantage point, such obstruction lighting will be marginally visible on clear nights and completely obscured during poor visibility. When visible it will be difficult to distinguish the navigational aids and aviation obstruction lighting from similar sources commonly visible throughout the Sound.

The preliminary lighting concept for the Project requires the FSRU deck and YMS be illuminated during the hour of darkness for safety and operational purposes, irrespective of the presence of an LNG carrier. For safety and security purposes, over-side lighting will be needed around the perimeter of the FSRU and YMS. Preliminary lighting levels for exterior areas are summarized in Table 2.

On clear nights, at distances of approximately nine (9) miles and greater from the nearest coastal vantage point, lighting will appear as a dim cluster of white or yellow/orange clusters on the horizon. Lights will tend to have a shimmering effect due optical refraction at such extended distances. From many beachfront locations the lights of the FSRU/YMS will be a point of visual interest when viewed within a largely dark setting. While these lights may be similar in appearance to a passing ship, the lights of the FSRU/YMS will be permanent and remain throughout the hours of darkness. Based on meteorological history, nighttime visibility will be obscured by weather conditions approximately ¼ of the time (refer to Table 7 on page 30).

The DEC Visual Policy provides a "universal list" of mitigation strategies to be incorporated, where applicable, to minimize visual and aesthetic impact. Where a project can demonstrate that all such strategies have been incorporated to the maximum extent practicable, the project can be deemed consistent with the requirements and intent of SEQRA relative to the visual discipline. In direct response to the DEC Visual Policy, the proposed project includes a variety of design and maintenance initiatives, that collectively and effectively avoid or mitigate aesthetic impact to the maximum extent practicable. For convenience, the following discussion of mitigation techniques follows the outline format of the universal list of mitigation strategies contained in the DEC Visual Policy (DEC Visual Policy, p. 6).

As an offshore natural gas terminal, the Project by its very nature, cannot take advantage of the screening effect of topography and vegetation afforded to land based facilities.

The proposed LNG terminal has been sited near the center of the Sound at its widest point, in part, to maximize the distance from any coastal vantage point and minimize potential visual impact on coastal resources. The LNG terminal will be approximately nine (9) miles from the nearest coastal vantage point. There is no location within the Sound where the project would be substantially farther from the nearest coastal observer. Moreover, at this distance, the visual impact on recreational boaters is minimized considering smaller watercraft typically navigate relatively close to shore.

The NYS DEC Visual Policy recommends that through sensitive design treatment, elements of particular concern can often be designed or dimensioned in a manner that reduces or eliminates impact on sensitive resources. The DEC Visual policy also recognizes that sometimes engineering, economic or other constraints preclude optimum dimensioning or other appropriate design treatments.

The FSRU is an offshore energy terminal designed to provide a source of reliable, long term, and competitively priced natural gas to this region. As such, its overarching design and dimension must follow the engineering requirements necessary to perform its intended function. All the hardware, LNG handling equipment, ancillary equipment and their arrangement act together to receive and process liquefied natural gas and deliver it to the gas transmission system. As such, traditional architectural and site design treatments are difficult to apply in a practicable manner.

To help minimize visual impact and reduce clutter on the top deck, the original design of the FSRU has been modified to place process heaters below deck.

Considering the proposed project will be visible over open water from a wide viewshed area, traditional land-based treatments such as fences, earthen berms and vegetative screening cannot be applied in a practicable manner to an offshore facility.

The Project has been sited in the center of the Sound at its widest point to minimize potential environmental and socio-economic impacts, while still meeting engineering and design criteria. The location in the center of the Sound also maximizes the distance from any coastal vantage point and, thereby, minimizes visual impact. Selecting an alternative location at any other location within the Sound would result in increased visual impact. Selecting an alternative outside the Sound is not a preferred option due to the need for significant additional new pipeline construction, and associated environmental and socioeconomic impacts.

Broadwater undertook an extensive alternatives analysis to arrive at the proposed Project location. A complete discussion of the alternatives considered (including No-Action or Postponed Alternatives, System Alternatives, LNG Terminal Alternatives, and Pipeline Route Alternatives) is presented in Resource Report 10 (Alternatives).

The aim of camouflage is to prevent recognition of the object by removing or altering clues to its nature. The principles of camouflage are to alter the form, shadows, texture, colors and silhouette of an object to hinder its recognition, and to make the object blend into the background or the surrounding landscape. The most important techniques of camouflage are countershading and disruptive coloration.

While the color of the FSRU/YMS structure has not been determined, there are options available. For example, borrowing from the camouflage techniques of the U.S. Navy, shades of gray can be used to minimize contrast between the LNG terminal and the washed out distant blue – gray colors of the background as well as the foreground waters of the Sound. Final color selection may also be influenced by U.S. Coast Guard requirements that have not yet been determined.

Private shipping companies under contract to Broadwater Energy will operate transient LNG delivery vessels. Many individual vessels of varying size and configuration will service the FSRU on a regular basis. Broadwater Energy has no control over the coloration or visual character of these vessels. It is likely that privately operated vessels many maintain a color scheme that, to some degree, contrasts with the colors of the background landscape (waterscape). However, the visual character of these LNG carriers will not vary appreciably from the existing commercial fleet that utilizes the Sound.

The profile of the FSRU is dictated by the various functions and support equipment that allow for the safe and efficient handling, processing and delivery of LNG to the gas transmission system. Every effort has been made to minimize its' profile where safety and other engineering criteria are not compromised.

The size of the FSRU is sufficient to provide a source of reliable natural gas to the region at the volumes required and accommodate LNG carriers of sufficient size. Reducing the size of this project will compromise the ability of achieve these established criteria.

A complete discussion of the numerous equipment and technology alternatives that Broadwater evaluated in arriving at the proposed Project is presented in Resource Report 10 (Alternatives).

Materials selected for construction of the FSRU and its outside equipment will be consistent with all specifications necessary to safely receive, process and transmit LNG. Where specifications permit, non-specular materials will be used on all outside surfaces, equipment and hardware to reduce glare whenever possible.

Exterior lighting of deck facilities and other structures will utilize best management practices including: 1) lighting only those areas where access is required after dark; 2) shielding areas requiring frequent night access from off-site view; 3) turning off lights in areas when work is not being performed; 4) limiting illuminance to the minimum degree necessary to assure a functional and safe work environment; 4) using shielding mechanisms to prevent off-site glare; and 5) using low reflectance materials where practical to avoid reflected illumination.

Due to the height of the emergency burn-of flare (279 feet [85 m] above waterline), the Federal Aviation Administration will likely require aviation obstruction lighting to assure safe flight navigation in the vicinity of the FSRU. Similarly, because the Project includes a helideck (for emergency transport only), a flashing aviation obstruction light will also be mounted on the radar mast (177 ft [54 m]). For safety reasons the emergency burn off flare cannot be reduced in height and the helideck cannot be eliminated. Therefore the presence of aviation obstruction lighting is an unavoidable impact.

The U.S. Coast Guard similarly requires maritime obstruction lighting to assure safe navigation in the vicinity of the FSRU. These are federally mandated safety features and cannot be omitted of reduced.

How a landscape and structures in the landscape are maintained has aesthetic implications to the long-term visual character of a project. Broadwater Energy places a high priority on facility maintenance, not only for operational purposes, but for aesthetic appearance as well. Broadwater recognizes that its public image will be directly linked to the outward appearance of its facilities. Desiring to be a welcomed member of the New York and Connecticut coastal communities, Broadwater will implement a strict policy of maintenance, including using marine sensitive treatments, materials and practices that ensure a clean and well maintained appearance over the full life of the facility.

The process of removing the FSRU from its site is straightforward: Upon decommissioning, the FSRU will be removed (de-coupled) from the YMS and towed to a shipyard to be overhauled for reuse

or recycled, as appropriate. The mooring tower would be removed from the seafloor or, alternatively, it could be left in place and converted to an aid to navigation.

The proposed LNG terminal is approximately nine (9) miles from the nearest coastal vantage point. At such extreme distance, the incorporation of proposed design mitigation techniques, combined with earth curvature, atmospheric perspective (hazing) and sheer distance substantially and effectively mitigate negative impacts of the project on visual resources of statewide significance or local importance. Therefore, no offset mitigation is necessary.

The Broadwater Energy Project has been sited near the center of the Long Island Sound at its widest point, in part, to maximize the distance from any coastal vantage point and minimize potential visual impact on coastal resources. The LNG terminal is nine (9) miles off the Long Island coast and ten (10) miles off the coast of Connecticut. There is no location within the Sound where the project would be substantially farther from the nearest coastal observer.

The outer limits of the evaluated study area extend to a distance of twenty-five miles from the proposed LNG terminal. This study radius was selected considering the following factors:

- Curvature of the Earth - For an observer standing approximately 40 feet above sea level at a distance of 25 miles from the facility, all portions of the FSRU below the Helideck (148 feet [45m] above waterline) will be below the visible horizon. Similarly, for an observer standing at beach elevation, the helideck would disappear below the horizon at a distance of approximately 20 miles.
- Meteorological Visibility - The proposed LNG terminal will be completely obscured from all coastal vantage points by haze or fog at least 24 percent of the time.
- Sheer Distance - A broadside view of the FSRU at a distance of 25 miles would measure only 0.6 degrees horizontally on the horizon and 0.08 degrees vertically. At such extended distance, it is unlikely that this limited visibility would be considered a significant point of interest to t typical observer.

The vast majority of views of the proposed LNG terminal structures will be limited to immediate shoreline locations. In most locations project visibility is quickly screened from inland vantage points by dense coastal vegetation, topography and structures.

The north shore of Long Island includes nearly 55 miles of coastline within the 25-mile study radius. Of this, the proposed LNG terminal will be visible from approximately 44 miles of coastline (80%). The Connecticut side of the Sound within the 25-mile study radius includes nearly 92 miles of coastline. Of this, the proposed LNG terminal will be visible from approximately 46 miles (50%) of the shoreline. No coastal areas with approved NYS Local Waterfront Revitalization Plans (LWRPs) fall within the affected viewshed area.

Broadwater Energy has conducted a through inventory of all aesthetic resources meeting the NYSDEC definition of statewide significance, and a more conservative definition of resources of local interest within the 25-mile study radius. 228 locations meeting theses definitions were identified within the affected viewshed area. The vast majority of resources of statewide significance or local interest found along the Long Island and Connecticut coastlines are public beaches and waterfront parks.

The Connecticut and Long Island coastal area includes numerous private residential properties (both permanent and second homes) that are clearly oriented to take advantage of scenic Sound views. These properties are found at beach level and on surrounding hillsides with unimpeded views towards the Sound. Because of these views, these homes are almost always of very high real estate value and are

often cherished places for families who live or vacation there. The coastal area is also a popular seasonal tourist destination. Visitors to waterfront hotels and smaller bed and breakfast type establishments, open to the general public, choose to vacation along the Sound to enjoy the scenic, recreational, social, peaceful and cultural ambiance of the coastal landscape.

Affected viewers will most commonly be local residents enjoying Sound views from their homes or neighborhoods, and visitors enjoying passive or active recreational pursuits from coastal or on-water locations. While such viewers will likely be more sensitive to the presence of the proposed LNG terminal than other viewer groups, viewers who recognize and understand the Sound as a multi-purpose body may be less affected by the presence of the proposed LNG terminal on the distant horizon.

The proposed LNG terminal will be the largest moored object on the Sound. However, with the nearest coastal vantage point approximately nine (9) miles distant, all shoreline receptors will view the proposed Project within the far background distance zone. At this distance, elements lose detail and become less distinct. Typically, atmospheric perspective (hazing) reduces colors to blue-grays, while surface characteristics (lines and textures) are lost. On clear days the FSRU/YMS and LNG vessel may be a point of visual interest for observers at the closest vantage points along both the New York and Connecticut coastlines. However, the proposed LNG terminal will decrease in visibility from distant receptors up and down the coast with increased distance over the horizon and the compounding effect of atmospheric perspective.

When visible, the proposed facility will generally appear as a small two-dimensional rectilinear form on the horizon from distant coastal vantage points. Although a relatively small element within the context of the Sound, the geometric form of the LNG terminal contrasts with the expansive planar form of the Sound and sky. While the outline of the Project will break the visible horizon, from distant coastal vantage points the Project will appear quite low and, as distance increases, increasingly difficult to distinguish from the horizon.

The proposed LNG terminal has been sited near the center of the Sound at its widest point, in part, to maximize the distance from any coastal vantage point and minimize potential visual impact on coastal resources. The LNG terminal will be approximately nine (9) miles from the nearest coastal vantage point. There is no location within the Sound where the project would be substantially farther from the nearest coastal observer. While the color of the FSRU/YMS structure has not been determined, there are options available. For example, shades of gray can be used to minimize contrast between the LNG terminal and the washed out distant blue – gray colors of the background as well as the foreground waters of the Sound. These factors combine to minimize visual distinction and perceived importance of the Project within the context of the regional landscape (waterscape). Importantly, any residual impacts will not be permanent. As required by the DEC Visual Policy, at the end of its useful life the FSRU/YMS will be decommissioned by complete removal, restoring the Sound to its pre-Project visual condition.

The NYSDEC visual Policy states,

> " Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Significant aesthetic impacts are those that may cause a diminishment of the public enjoyment and appreciation of an inventoried resource, or one that impairs the character or quality of such a place. Proposed large facilities by themselves should not be a trigger for a declaration of significance. Instead, a project by virtue of its siting in visual proximity to an inventoried resource may lead staff to conclude that there may be a significant impact."

Based on this definition, it is reasonable to conclude that simple visibility of the proposed LNG terminal (albeit a large facility) does not result in detrimental effect on the perceived beauty of a place or structure; nor will the project cause the diminishment of public enjoyment and appreciation of an inventoried resource, or impair the character or quality of such a place.

Glossary[10]

Aesthetic impact: Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a project proposal, should not be a threshold for decision-making. Instead a project, by virtue of its visibility, must clearly interfere with or reduce the public's enjoyment and/or appreciation of the appearance of an inventoried resource (e.g. cooling tower plume blocks a view from a State Park overlook).

Aesthetically significant place: A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, millions of people visit Niagara Falls on an annual basis. They come from around the country and even from around the world. By these measurements, one can make the case that Niagara Falls (a designated State Park) is an aesthetic resource of national significance. Similarly, a resource that is visited by large numbers who come from across the state probably has statewide significance. A place visited primarily by people whose place of origin is local generally is generally of local significance. Unvisited places either have no significance or are "no trespass" places.

Aesthetic Quality: There is a difference between the quality of a resource and its significance level. The quality of the resource has to do with its component parts and their arrangement. The arrangement of the component parts is referred to as composition. The quality of the resource and the significance level are generally, though not always, correlated.

Atmospheric perspective: Even on the clearest of days, the sky is not entirely transparent because of the presence of atmospheric particulate matter. The light scattering effect of these particles causes atmospheric or aerial perspective, the second important form of perspective. In this form of perspective there is a reduction in the intensity of colors and the contrast between light and dark as the distance of objects from the observer increases. Contrast depends upon the position of the sun and the reflectance of the object, among other items. The net effect is that objects appear "washed out" over great distances.

Control Points: The two end points of a line-of-sight. One end is always the elevation of an observer's eyes at a place of interest (e.g. a high point in a State Park) and the other end is always an elevation of a project component of interest (e.g. top of a stack of a combustion facility or the finished grade of a landfill).

Line-of-sight profile: A profile is a graphic depiction of the depressions and elevations one would encounter walking along a straight path between two selected locations. A straight line depicting the path of light received by the eye of an imaginary viewer standing on the path and looking towards a predetermined spot along that path constitutes a line-of-sight. The locations along the path where the viewer stands and looks are the control points of the line-of- sight profile.

Scientific Perspective: Scientific, linear, or size perspective is the reduction in the apparent size of objects as the distance from the observer increases. An object appears smaller and smaller as an observer moves further and further from it. At some distance, depending upon the size and degree of contrast between the object and its surroundings, the object may not be a point of interest for most people. At this hypothetical distance it can be argued that the object has little impact on the composition of the landscape of which it is a tiny part. Eventually, at even greater distances, the human eye is incapable of seeing the object at all.

Viewshed: A map that shows the geographic area from which a proposed action may be seen is a viewshed.

[10] NYSDEC Visual Policy (2000) pp. 9-11.

Visual Assessments: Analytical techniques that employ viewsheds, and/or line-of-sight profiles, and descriptions of aesthetic resources, to determine the impact of development upon aesthetic resources; and potential mitigation strategies to avoid, eliminate or reduce impacts on those resources.

Visual impact: Visual impact occurs when the mitigating effects of perspective do not reduce the visibility of an object to insignificant levels. Beauty plays no role in this concept. A visual impact may also be considered in the context of contrast. For instance, all other things being equal, a blue object seen against an orange background has greater visual impact than a blue object seen against the same colored blue background. Again, beauty plays no role in this concept.

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APPENDIX E

FAA FORM 7460-1

Notice of Proposed Construction or Alteration (7460-1)

Project Name: BROAD-000029200-05 **Sponsor:** Broadwater Energy

Details for Case : LNG Terminal

Show Project Summary

Case Status

Status: Submitted
ASN:
Next Step: None

Date Submitted: 12/02/2005
Date Accepted:
Date Determined:
Letter: None

Construction / Alteration Information

Notice Of: Construction
Duration: Permanent
If Temporary : Months: Days:
Work Schedule - Start: 01/01/2009
Work Schedule - End: 12/31/2010

Structure Summary

Structure Name: LNG Terminal
Structure Type: Other - without Antenna
Other : Emergency Flare
FCC Number: 1111111
Prior ASN:

Structure Details

Latitude:	41° 6' 1.31" N
Longitude:	72° 50' 44.56" W
Horizontal Datum:	NAD83
Horizontal Accuracy:	None
Site Elevation (SE):	0 (nearest foot)
Structure Height (AGL):	279 (nearest foot)
Marking/Lighting:	Other
Other :	Emergency Flare
Nearest City:	New Haven
Nearest State:	Connecticut
Traverseway:	No Traverseway
Description of Location:	The proposed Broadwater LNG terminal will be located in Long Island Sound, approximately 9 miles (14.5 kilometers [km]) from the shore of Long Island in the Town of Riverhead, Suffolk County, in New York State Waters
Description of Proposal:	The proposed LNG terminal will consist of a FSRU that is approx. 1,215ft in length, 200ft in width and 80 ft above the water line.

Common Frequency Bands

Low Freq	High Freq	Freq Unit	ERP	ERP Unit

Specific Frequencies

Close